Rajarshi Janak University

Janakpurdham, Dhanusha,

Nepal

Curriculum of Bachelor in computer Application
Under
Humanities and Social Sciences

Submitted By

Faculties of Humanities and Social Sciences

Rajarshi Janak University

Janakpurdham, Nepal

(2075)

Program title

The title of the program is Bachelor in Computer Application.

About course:

Bachelor in Computer Application (BCA) is an undergraduate degree course in computer applications. It a is four years (8 semesters) program. With the swift growth of IT industry in Nepal, the demand of computer professional is increasing day by day. This increasing growth of IT industry has created a lot of opportunities for the computer graduates.

Course Objective

The program prepares students with competent skill-sets and comprehensive knowledge of diverse verticals in the Computer Application field and helps them to take up different technical responsibilities in the industry.

The program covers comprehensive technical knowledge, in demand by various industry domain and in the fields of software Programmer, System and Network Administrator, Web Designer, Faculty for Computer Science/Communication Technology, etc.

Course purpose

To demonstrate the ability to adapt technological changes and innovations in the discipline.
To analyze, design, implement and evaluate computerized solutions to real life problems using appropriate computing method.
To develop computer programs using functional programming and object-oriented programming paradigms.
To apply techniques of software validation and reliability analysis to the development of computer programs.
To demonstrate critical thinking and develop communication skills
To acquire the knowledge, skills, experience and values to become lifelong learners and be able to get employment in the computer-related field or go for the further study.

Future scope

After the completion of BCA, students will have the option of becoming computer operator to data entry operator to the system administrator. They can seek jobs both in public and private sectors, and insurance, accounting, stock markets, e-commerce and marketing.
If one does not want to do job after BCA, then he/she may go for the higher studies MCA, MBA, Etc. Rather he/she can peruse special courses like Masters in Animation, Master's Degree in Information Management (MIM), Masters in Computer Management (MCM) etc.

Eligibility

The student who has passed +2 , Intermediate, PCL or equivalent level with minimum of 40% marks or aggregate C grade(at least 1.61 GPA) from any stream shall be eligible to join the BCA course on the basis of marks obtained in entrance.

Bachelor in Computer Application (BCA)
(Humanities and Social Sciences)

Courses	Credit hours
Computer Application	73[(23 * 3)+(1*4)]
Language courses	9(3*3)
Mathematics and statistics course	9(3 *3)
Social Sciences & Management courses	12(4*3)
Elective curse	12(4*3)
Projects	10(2*2+6)
Internships	3
Total Credit Hours	128

Curriculum Structure

First Year/First semester

Sr.No	Course Code	Course Title	Credit hours
1	HCAC-101	Computer Fundamental and Office Automation	3
2	HENG-102	Foundation course in computing English-I	3
3	HMTH-103	Math-I	3
4	HCAC-104	Programming in C	3
5	HCAC-105	Digital Logic	3
			15

First Year/Second semester

Sr.No	Course Code	Course Title	Credit hours
1	HCASO-151	The art of social engagement and Technology	3
2	HENG-152	Technical English	3
3	HMTH-153	Math-II	3
4	HCAC-154	C++ programming	4
5	HCAC-155	OPERATING SYSTEM	3
			16

Second Year /Third semester

Sr.No	Course Code	Course Title	Credit hours
1	HCAC-201	Financial Accounting	3
2	HCAC-202	Data Structures & Algorithm	3
3	HCAC-203	Microprocessor & Assembly language	3
4	HCAC-204	Computer Oriented Numerical Methods	3
5	HCAC-205	Data communication and Computer Networking	3
			15

Second Year/ Fourth semester

Sr.No	Course Code	Course Title	Credit hours
1	HCAC-251	Java programming	3
2	HCAC-252	Database Management System	3
3	HCAC-253	Computer Architecture	3
4	HCAC-254	System Analysis and Design	3
5	HCAC-255	Discrete Structure	3
6	HCAPJ-256	Project -I	2
			17

Third year / Fifth semester

Sr.No	Course Code	Course Title	Credit hours
1	HCAC-301	e- Governance	3
2	HCAC-302	Web designing	3
3	HCAEC-303	Applied economics	3
4	HCAST -304	Probability & Statistics	3
5	HCAC-305	.Net Technology	3
			15

Third Year / Sixth semester

Sr.No	Course Code	Course Title	Credit hours
1	HCAC-351	MIS and e-commerce	3
2	HCAC-352	Cyber law and computer Ethics	3
3	HCAC-353	Software Engineering	3
4	HCAC-354	Advance Java programming	3
5	HCAC-355	Computer Graphic	3
	HCAPJ-356	Project- II	2
			17

Fourth Year/Seven semester

Sr.No	Course Code	Course Title	Credit hours
1	HCAC-401	PROGRAMMING IN PYTHON	3
2	HCAOR-402	Operational Research	3
3	HCANP-403	व्यवहारिक लेखन तथा सम्पादन	3
4	HCAIN-404	Internships	3
5		Elective –I	3
6		Elective –II	3
			18

Elective subjects:

Sr.No	Course Code	Course Title
1	HCAC-471	Cloud Computing
2	HCAMT-472	ERP
3	HCAC-473	Artificial Intelligence
4	HCAC-474	GIS
5	HCAC-475	Data Warehousing and Data Mining

Fourth year/Eight semester

Sr.No	Course Code	Course Title	Credit hours
1	HCAC-451	Mobile programming	3
2	HCAPJ-452	Project – III	6
3		Elective-III	3
4		Elective -IV	3
			15

Elective Subjects:

Sr.No	Course Code	Course Title
6	HCAC-481	Database Administration
7	HCAC-482	Network management and Administration
8	HCAC-483	Linux Shell Programming
9	HCAC-484	Distributed System
10	HCAC-485	Advance .Net Technology
11	HCAC-486	Big data
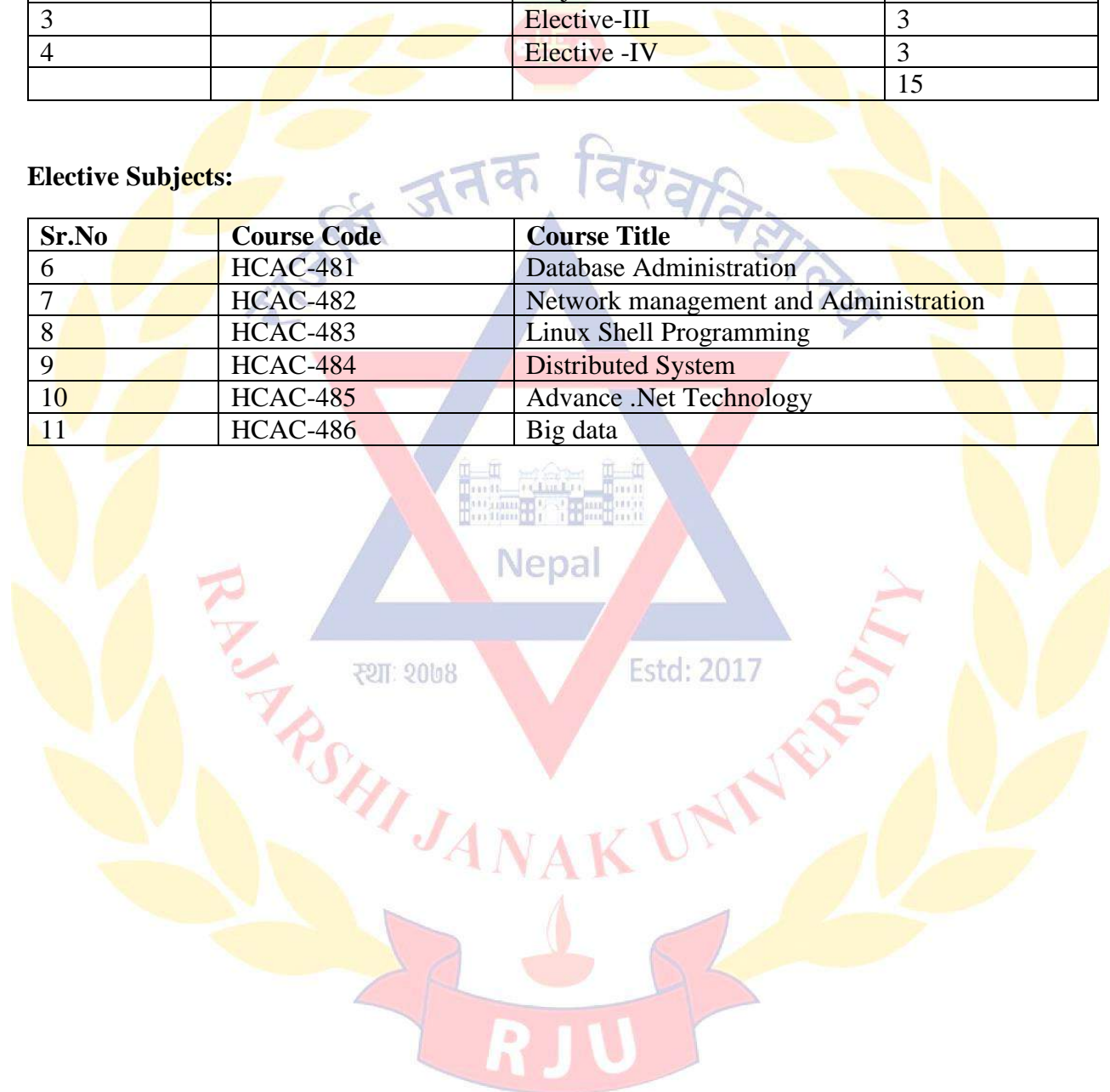
Course Title: Computer Fundamental and Office Automation

Course No: HCAC-101	**Credit Hours: 3**
Year/Semester: I/I	**Full Marks: 60+20+20**
Nature of Course: Nature of course: Theory + Lab	**Pass marks: 24+8+8**

Course objectives:

- To Know the Basics of Computer. It helps to gain knowledge of how computer system has made enormous changes in different era with the advancement in technology
- To understand the Basics of Operating systems and implementation of windows and Linux operating system.
- To understand how to use software packages in day to day activities.

Course contains:

UNIT I : Computers Overview [5 hrs.]

Characteristics of Computers, the evolution of Computers, Computer Generations: First Generation, Second Generation, Third Generation, Fourth Generation, Block Diagram of Computer, Input Unit, Storage Unit, Memory size, Output Unit, Arithmetic Logical Unit, Control Unit, Central Processing Unit, Applications of Computer, Capabilities and limitations of computer.

UNIT II: Storage Fundamentals [8 hrs.]

Primary Vs Secondary Storage, Primary Storage: RAM ROM, PROM, EPROM, EEPROM, Registers, computer buses, Cache memory, Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy Optical Disks, Compact Disks, Zip Drive, Flash Drives.

UNIT III: Input/output devices [9 hrs.]

Role of I/O devices in a computer system. Secondary Storage Devices: Sequential and Direct-Access Devices, Input Devices: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Devices: Monitors and its types. Printers: Impact Printers and Non-Impact Printers and their types, Plotters and its types, Sound cards, Speakers.

UNIT IV: Software [9Hrs.]

Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages, Software and its needs, Types of Software: System Software: Operating System, Utility Programs, Language processor: Assembler, interpreter and compiler, Application S/W and its types, Open source software, Role and function of operating system, Types of Operating Systems, Structure of Operating System

UNIT V: DBMS & computer security [5Hrs.]

File Systems and Database Management Systems, Different Types of Database Management System, threats to computer security, computer viruses and its types, solution to computer security threats, e-Waste disposal, e-Waste disposal process and benefits of e-waste recycling

UNIT VI: Communication System   **[9Hrs.]**

Basic Elements of a Communication System, Data Transmission Modes, Data Transmission Speed, Data Transmission Media, Digital and Analog Transmission, Network Topologies, Network Types (LAN, WAN and MAN), OSI reference Model, Internet: Client and Servers, Host &Terminals, TCP/IP, World Wide Web, Hypertext, web site, web pages, Web Browsers, Blogs, IP Address, Uniform Resource Locator, Domain Name, Internet Services Providers, Risks involved with Social media websites, Internet Security, web Search Engine, Net Surfing, Internet Services, Intranet.

Laboratory works

Lab 1. Operating system
Working with operating system, starting and closing of program, concept of path & wild cards, managing files and folders, display properties, using CD player, media player, using volume control, Basic MS-DOS commands

Lab 2. Editors and Word Processors
Introduction to Desktop Publishing, MS-Word, Spreadsheets Purpose, Usage, Commands, MS-Excel, MS -PowerPoint

Lab 3. Linux
Introduction to Linux, Basic Linux Commands, Permission, Pipes

Text book
1. Computer Fundamentals, Anita Goel, Pearson Education
2. E. Balagurusamy, "*Fundamentals of computers*." Tata Mcgraw Hill Education PVT Ltd, 2009

Referential Books:
1. Computer Fundamental – By Pradeep. K. Sinha, priti Sinha, 6th edition, B.P.B publication
2. Linux for Dummies 8th Edition, by Dee-Ann LeBlanc, Richard K. Blum
3. Shelly Cashman Series*," Discovering Computers & Microsoft Office 365 & Office 2016*": A Fundamental Combined Approach (MindTap Course List) 1st Edition, by Jennifer T. Campbell , Steven M. Freund , Mark Frydenberg , Mary Z. Last , Philip J. Pratt
4. Linux for Beginners: An Introduction to the Linux Operating System and Command Line **by Jason Cannon**

Course Title: Foundation course in computing English-1
Course No: HENG-102   **Credit Hours: 3**
Year/Semester: I/I   **Full Marks: 60+40**
Nature of Course: Nature of course: Theory   **Pass Marks: 24+ 16**

Course objectives:

- This course develops the basic English language skills you will need to work and study in a technological environment.

- It aims to help to develop a wide variety of relevant subject-specific language skills and to acquire knowledge of computers and IT expertise in English.

- The course is also ideal for professionals working in an IT industry where English has become the required language.

- To help professionals who use computers in areas such as: technical support, computer engineering, software design, web design, desktop publishing, computer security, network administration, and blog writing and administration.

Course Contents:

UNIT 1 Personal computing The processor **Language focus A** Contextual reference	3Hrs.	**UNIT 7** Computer viruses Computer security **Language focus G** Listing
UNIT 2 Portable computers Operating systems **Language focus B** World formation prefixes		**UNIT 8** Computers in the office Information systems **Language focus H** The passive
UNIT 3 Online services Data transmission **Language focus C** World formation suffixes		**UNIT 9** Computers in education CALL **Language focus I** Giving examples
UNIT 4 Programming and languages **Language focus E** Making comparisons		**UNIT 10** Computers in medicine Data storage and management **Language focus J** Explanations and definitions
UNIT 5 **Computer software** **Comparing software package**		**UNIT 11** Robotics Robot characteristics **Language focus K**

	Compound nouns
UNIT 6 Computer networks Network configurations **Language focus F** Time sequence	**UNIT 12** Virtual reality VR input devices **Language focus L** Classifying
UNIT 13 Machine Translation AI and Expert System **Language focus M** Cause and effect	**UNIT 14** Multimedia Computer-to-video conversion **Language focus N** Making predictions
UNIT 15 Computer graphics 24-bit colour	

Text Book:

- Oxford English for Computing ,Keith Boeckner, P.Charlesd Brown
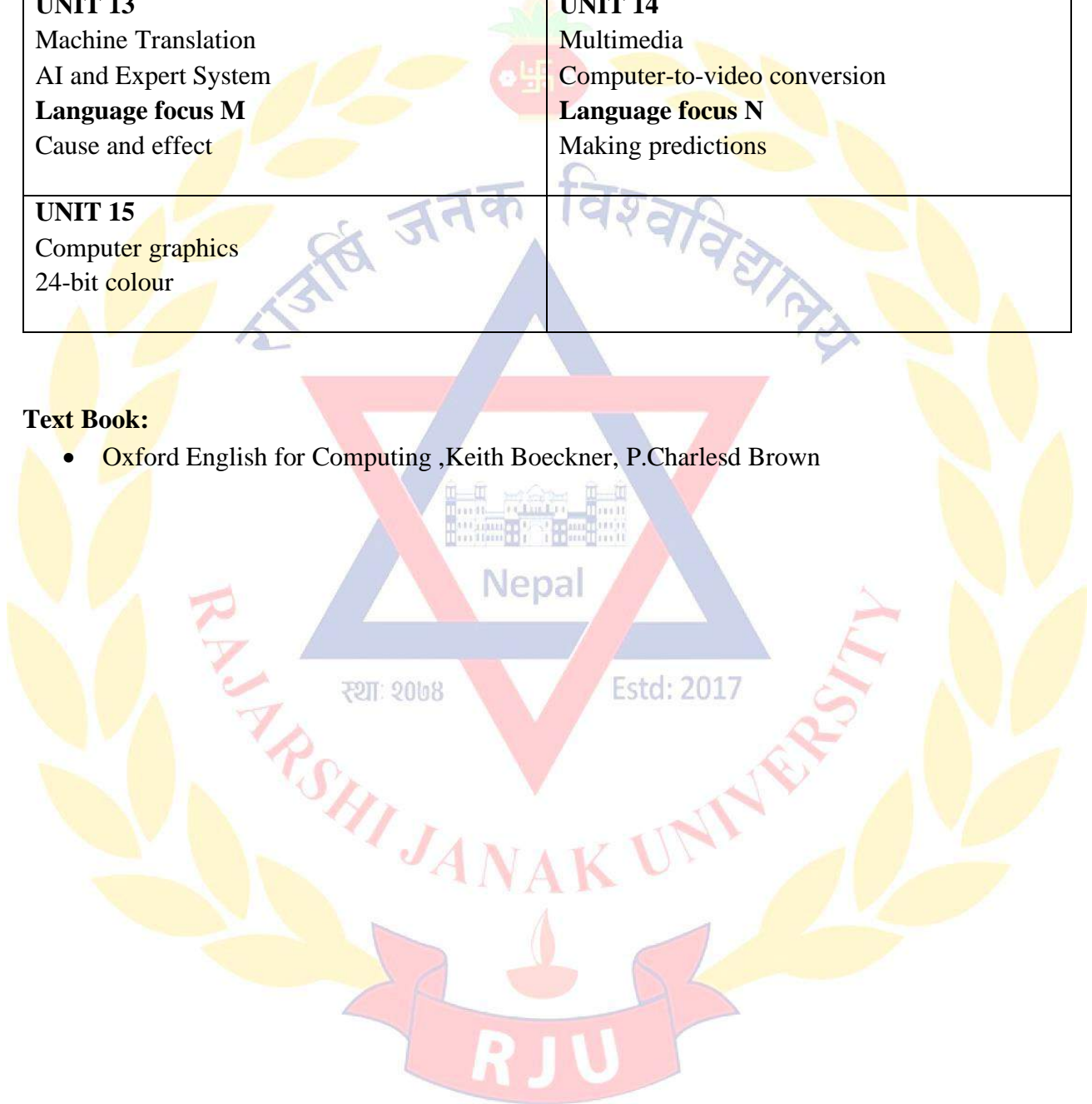
Course Title   : MATH-I
Course No   : HMTH-103   **Credit Hours : 3**
Year/Semester: I/I   **Full Marks   : 60+40**
Nature of Course: Theory+ Practical   **Pass Marks   : 24+16**

Course Objectives:

- The objective of this course is to impart fundamental mathematical background of real and complex number, relations and functions, theory of matrices and determinants, progressions, permutations and combinations, and coordinate geometry to develop skills in students for pursuing computer application courses.

Course Content:

UNIT I: REAL AND COMPLEX NUMBER SYSTEMS   [7 Hrs.]

Concept of Numbers, Numerals of Hindu-Arabic Decimal number system; Natural Numbers, Whole Numbers, Integers, Rational and Irrational numbers constituting Real Number System; Equality and inequality of real numbers, Order properties; Finite and Infinite intervals; Imaginary unit; Complex Numbers, their notations and geometrical representation; Algebra of complex numbers; Conjugate as absolute value of complex number and their properties.

UNIT II: RELATIONS AND FUNCTIONS   [6 Hrs.]

Ordered pairs and Cartesian Product; Relation and, its domain and range; Properties of Relations: Reflexivity, Symmetry, Anti-symmetry and Transitivity; Equivalence Relation; Partial Order Relation and Hassel diagram Lattice; Function, its domain and range; Injective, Surjective and Bijective Functions; Composite and Inverse Functions; Algebraic, Trigonometric, Exponential, Logarithmic, Modulus, Floor and Ceiling functions, their graphs.

UNIT III: MATIRX AND DETERMINANT   [7 Hrs.]

Concepts of matrices and notations; Relations between matrices; Some special types of matrices; Algebra of matrices; Transpose of matrix; Symmetric and Skew-symmetric matrices; Determinant and properties of determinants (without proofs); Singular and Non-singular matrices; Minors and Cofactors; Adjoint and Inverse of square matrices; Echelon forms and Rank of Matrices; Linear Transformations using matrices.

UNIT IV: PROGRESSIONS   [8 Hrs.]

Concept of sequences; Classical and Modern definitions of sequence with examples; Arithmetic, Geometric and Harmonic Progressions and their properties; Arithmetic, Geometric, Harmonic Means and relations among them; Infinite Series, Partial sums and Remainders; Conditions for an infinite series to have sum; Sum of an infinite geometric series.

UNIT V: PERMUTATIONS AND COMBINATIONS: [8 hrs.]

Fundamental additive and multiplicative principles of counting; Factorial Notations; Concept and definitions of Permutations and Combinations; Linear and Circular Permutations; Permutations of distinct things with and without repetitions allowed; Permutations of things not all distinct; Properties of Combinations; Restricted Combinations; Combinations of things not all distinct.

UNIT VI: COORDINATE GEOMETRY   [9 Hrs.]

Conic sections (Pair of straight Line, Circle, Ellipse, Parabola and Hyperbola) as locus of point; Different conics as plane sections of right circular cone; Different Forms of Equations of conics and their graphs; Determination of parts of conics from their equations and vice versa.

Introduction of Coordinates in Space; Distance and section formulae; Direction cosines and ratios; Angle between two lines; Projections on line and plane; Plane and its equations in different forms; Plane through three given points.

Practical work:

For technical computing "MATLAB" is used. It incorporates visualization, computation, and programming in a practical environment where by mathematical notation problems and solutions are expressed. To explain above topic MATLAB should be used to for practical demonstration.

TEXT BOOK:

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

REFERENCES

- Bajrachary D. R., Shrestha, R.M. &et al, "Basic Mathematics, Grade XI, XII", Sukunda Pustak Bhawan, Nepal.
- Budnick, F. S., "Applied Mathematics for Business Economics and the Social Sciences", McGraw-Hill Ryerson Limited.
- Monga, G.S., "Mathematics for Management and Economics", Vikas Publishing House Pvt. Ltd., New Delhi.

Course Title: Programming in C
Course no: HCAC-104   **Credit hours: 3**
Year / Semester: I/I   **Full Marks   : 60+20+20**
Nature of course: Theory + Lab   **Pass Marks: 24+8+8**

Course Objectives:

- The main objective of HCAC-104 is to know the basic skill needed in programming. Students are able to write, compile, debug and run a program in C.
- Students will be able in finding solutions of different real-life problems and converting the solutions into computer program using C language (structured programming).
- Students will understand to write algorithm and flowchart of solutions to various real-life problems.
- After completing the course students will be able to read/write/search in a file through a C program.

Course Contents:

UNIT I: Introduction to Programming Concept   [4 Hrs.]

Introduction of Programming Language: Language Translator, Assembler, Compiler, Interpreter, Syntax and Semantics, Programming Design Tools: Algorithm, Flow chart, Pseudo codes, Features of good programme, Different Programming Techniques: Procedural Programming, Modular Programming, Object Oriented Programming

UNIT II: Introduction to C   [6 Hrs.]

History of C Programme, Basic Structure of C Programme, Character set, Token, Keywords and Comments, Variables and Constants, Rules for naming and declaring data variables, Data Types, Type Conversion, Input and Output, Operators: Arithmetic, Relational, Logical, Increment/Decrement, Assignment, Bitwise, Ternary/ conditional(:?), Comma

UNIT III: Control Structure   [7 Hrs.]

Selective Structure: If statement, If-else statement, Nested if-else statement, Switch statement, Conditional operator (:?) , Looping structure: While Loop, Do-while loop, For loop, Nested Loops , Jumping Statement: Goto Statement, Break Statement, Continue Statement, Exit Statement

UNIT IV: Function   [6 Hrs.]

Function Concept: Function definition and return statement, Function prototype, Different ways of using function, Call by value, call by reference, Recursion

UNIT V: Array, Pointer and String   [7 Hrs.]

Concept of array, Array declare, access and initialization, Multi-dimensional array, Strings and string manipulation, Passing array and sting to function, Concept of Pointer, Pointer address, dereference, declaration, assignment, initialization, Pointer Arithmetic, Array and Pointer, String functions in C

UNIT VI: Structure and Union [7 Hrs.]

Concept of Structure, Initializing, accessing member of structure, Array of structure, Structures and Function, Pointer to structure, Union, Different between union and structure

UNIT VII: Input output and File Handling [5 Hrs.]

Concept of File handling, File Access methods, Functions of file handling: fopen(), fclose(), fflush(), freopen(), Formatted input out, Character input output , Direct input output, Random file access, Error handling, File operation

UNIT VIII: Introduction to Graphics [3 Hrs.]

Modes, Initialization, Graphics Functions

Practical Works

- Designing algorithm and draw flow chart for sequence, decision making and repetition concept of general programming.
  - o Creating different shapes using graphics function.
  - o Use modes and initialization techniques
- Developing basic structure of C programme.
- Declaring and assigning variables and constants.
- Applying input and output build in function
- Using arithmetic operators
- Giving demo of type conversion
- Use of if, if-else and switch statement
- Use while, do-while, for and nested loop concept.
- Use of Jumping statement
- Prototype, call and define function
- Pass the different parameter methods
- Use call by reference methods using function.
- Create a recursion function
- Array declares, define, initialize.
- Creating a single or multi-dimensional array.
- Using pointer and demo for arithmetic function.
- Using different string function in program.
- Example of passing Array and String in function
- Creating structure data types with application of loop.
- Creating union data types.

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- Example of Structure and Function
- Creating file handling application for open, read, write and appends.
- Handling the random access files.
- Applying the text formatting function.

Project

Preparation of simple application using C with the feature of input, process, output and store in external file.

Learning Outcome

After completing this course students are able to

- Use basic skills in programming.
- Be able to write, debug and run a C-programming Language.
- Understand the concept flow control in C- programming.
- Use Arrays, Strings and Pointers in C language
- Implements file handling and graphics in their project.

TEXT BOOKS:

- Kanetkar, Y. P. (2008). *Let us C*8th Ed, New Delhi, BPB Publication (Unit 1 -8)
- Balagurusamy, E. (2007). Programming in ANSI C. New Delhi, India: Tata McGraw-Hill.

References materials:

- Raman, R. (1984). Computer programming in C, New Delhi, PHI. India
- Carlo Ghezi, Mehdi Jazayeri, "Programming Language Concepts", John Wiley and Sons
- B.S. Gottfried(2001), Schaum's Outline Series for Programming with C, Second Edition, Tata McGraw Hill Publishing Company, New Delhi

Course Title: Digital Logic
Course no: HCAC-105   **Credit hours: 3**
Year/semester: I/I   **Full Marks: 60+20+20**
 Nature of course: Theory + Lab   **Pass Marks: 24+8+8**

Course Objectives:

- The aim of the module is to introduce to the students the topics that include combinational and sequential circuit analysis and design, digital circuit design optimization methods using logic gates, multiplexers, decoders, registers, counters and programmable logic arrays.
- To emphasis is on the use computer aided tools in the design, simulation, and testing of digital circuits.

Course contents:

UNIT I: Binary Systems   [6 hrs.]

Digital Signals and Wave Forms, Digital Computers, Clock Wave Form, Number Systems, Number Base Conversions, Complements, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic, Binary arithmetic, Complementary numbering systems: 1's and 2's Complements, Binary subtraction using 1's complementary Method, Binary subtraction using 2's complementary Method, Binary Coded Decimal (BCD) Numbering system, BCD Addition, Excess-3 codes, Gray Code, 8 4 -2 -1 code, Error Detection and Correction Code.

UNIT II: Boolean Algebra and Logic Gates   [5 hrs.]

Introduction to Boolean Algebra: Binary Logic Functions, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Logic Operations, Logic Gates, Realization of Boolean Functions using Universal Gates: Timing Diagrams and Synchronous Logic, Integrated Circuits

UNIT III: Simplification of Boolean Functions   [5 hrs.]

Karnaugh Map or K – Map: Plotting a Boolean expression, Two and Three variable maps, Four variable maps, Analysis of SOP and POS Expression, NAND and NOR implementation, Don't Care conditions.

UNIT IV: Combinational Logic   [12 hrs]

Introduction to Combinational Circuits, Analysis Procedure, Design Procedure, Adders, Subtractors, Code Conversions, Multilevel NAND and NOR Circuits, Exclusive-OR Circuits, Binary Parallel Adder - Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Read-Only Memory, Programmable Logic Array, Programmable Array Logic

UNIT V: Sequential Logic   [9 hrs.]

Sequential Logics, Latches, Flip-Flops, Triggering of Flip-Flops, Excitation table of Flip-Flop, Interconversion of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Design Procedure, Introduction to Asynchronous Logics.

UNIT VI: Registers and Counters [8 hrs.]

Registers, Shift Registers, Universal Registers, Ripple Counters, Synchronous Counters, Other Counters, Timing Sequences, Application of Counter: Digital Watch

Laboratory Works:

The lab work should include:

- Familiarizations with logic gates
- Combinatorial Circuits
- Binary Parallel Adders and Subtractors
- Design with Multiplexers (1:16)
- Flip-Flops
- Registers
- Counters
- Digital Watch

TEXT BOOKS:

1. Digital Design, M. Morris Mano, M.D.Ciletti, 5th edition, Pearson.
2. DIGITAL FUNDAMENTALS, Ninth Edition, Thomas l. Floyd

REFERENCE BOOKS:

1. Fundamentals of Logic Design, C. H. Roth, L. L. Kinney, 7th edition, Cengage Learning.
2. B.R. Gupta and V.singhal, "Digital Electronics" 4th Edition, S.K Kataria & sons, India.
3. Fundamentals of Digital Logic & Micro Computer Design, 5TH Edition, M. Rafiquzzaman, John Wiley.

The Art of Social Engagement and Technology
Course no: HCASO-151   Credit Hours : 3
Year /Semester: I/II   Full Marks   : 60+40
Nature of Course: Theory   Pass Marks   : 24+16

Course Objectives:

- **"The Art of Social Engagement and Technology"** is a new course that explores the ways in which culture and social structures shape the design and use of technology, and how technology in turn influences cultural and social experience.

Course Contents:

UNIT -I: Introduction to sociology   [4 hrs.]

The nature of Sociology: The meaning of Sociology, Scope and Subject matter, Relationship of sociology with history, psychology, political science, economics and anthropology. Introduction to Applied Sociology.

UNIT - II: Social life   [10 hrs.]

Basic concept: Culture, Society, community, Institution, Norms and values, Group, Status and role, basic Institution of Nepalese Society: Kinship, Family, Marriage, Religion, Impacts of Information Technology on Society in the new Century.

Factors of social and cultural change, social problems (disorder and deviance) and social control. consequences of technological development on Nepalese societies.

UNIT - III: Stratification   [7 hrs.]

The structure and composition of Nepalese Society: Rural, Urban, Tribe, Weaker section, Dalits, women and minorities. Social Stratification and mobility: meaning and forms. Sociology of Globalization

UNIT - IV: Technology, jobs, and the future of work   [7 hrs.]

Developments in employment, income, and skills, how automation and technology are affecting work, The challenges of digitization—and possible solutions, Relation between Society and Technology: The technological society, Technology and Industrialization: Technology and Urbanization, Technology and Modernization, Development of the means of transport and communication, Transformation in the economy and the evolution of the new social classes:, Technology and Unemployment, Technology and war, Changes in social institutions,

UNIT - V: Social engagement   **[7 hrs.]**

Defining social engagement, Measuring social engagement, The value of social engagement for health outcomes, Social engagement and mortality, Social engagement and physical markers of health, Social engagement and cognitive decline, Social engagement and mental health, Barriers to social engagement, the potential of emerging technologies, Current dissemination of social engagement technologies, Understanding technology use and acceptance predictors, The role technology can play in combating barriers to social engagement

UNIT - VI: Research Methods in Sociology   **[10 hrs.]**

Practical in Sociology: Methods and Techniques Methods: Participant Observation, Survey, Tools and Techniques: Observation, Interview, Questionnaire, the Significance of Field Work in Sociology

Text Books:

1. Abraham, M. Francis, 1982, Modern Sociological Theory: An Introduction, Calcultta: Oxford University Press, pp. 72-113, 209-242
2. Andersen, M.L. & Taylor, H.F., Understanding sociology, New Delhi
3. Bista, D.B. 1996. People of Nepal, Kathmandu: Ratna Prakashan.

References:

1. Inkles, Alex.1964, What is Sociology. Delhi Prentice- Hall of India private Limited. Giddens, A. and Mitchell, D. 2000.
2. Bryman, A(2008), Social research methods (3rd ed). New York, new Delhi.
3. Creswell, J.W.(2011). Research design: qualitative, quantitative and mixed methods approach, New Delhi: SAGE

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Course Title: Technical English
Course Code: HENG. 152   **Credit Hours: 3**
Year/Semester: I/II   **Full Marks: 60+40**
Nature of the Course: Theory   **Pass Marks: 24+16**

Course Objectives:

- To impart effective communicative language skills to students and enable them to use language accurately, clearly, and concisely.
- To enhance the capacity of students to read a text critically.
- To equip students with the modern technical communicative language that is widely used in computer study.
- To familiarize them with the language used in computer science and help them to communicate in the other fields as well.
- To enable students to improve their work-related writing skills.

Course Contents:

Part-I Technical English

UNIT – I: Communication in English   [6 hrs.]

Introduction: Basics, Cross-cultural Communication, Effective Communication, Importance of Technical Communication, Classification of Barriers, Objective and Characteristics of Technical Communication

UNIT - II: Listening and Speaking in English

Active Listening: Reasons for Poor Listening, Traits of a Good Listener, Types of Listening
                                                                          [3 hrs.]
Effective Speaking: Achieving Confidence, Clarity, and Fluency; Barriers to Speaking; Types of Speaking; Persuasive Speaking; Public Speaking   [5 hrs.]

UNIT - III: Reading and Writing in English

Reading: Reading and Interpretation, Intensive and Extensive Reading, Critical Reading, Reading for Different Purpose, Reading Comprehension   [5 hrs.]

Technical Writing: Audience Recognition/Analysis, Techniques for Good Technical Writing, Letters, Business Letters, Cover Letters, Resumes, Memos, Email   [7 hrs.]

UNIT - IV: Modern Communication in English   [5 hrs.]

Technology-based Communication Tools, Positive Impact of Technology-enabled, Negative Impact of Technology-enabled, Selection of Appropriate Technology, Effectiveness of Technology-based Communication

Part II: Mass Media and Technology   [17 hrs.]

1. Computers and the Pursuit of Happiness
2. We've Got Mail
3. Propaganda Techniques in Today's Advertising
4. Students Shall Not Download. Yeah, Sure.
5. Don't Touch That Dial
6. All Watched Over by Machines of Loving Grace

Teaching Methods

The course expects Communicative Language Teaching (CLT). While facilitating, the instructors are expected to stimulate the students to work as per the spirit of the course and make learning a joyful experience. Students Focused and Task-Based methods can be entertained more.

Evaluation

> **Internal Evaluation: 40%**
> Attendance-5
> Presentation/Classroom Participation/Group Discussion-5
> Writing Sample-15
> Mid-Term Test-15

> **Final Evaluation: 60%**
> Comprehension
> Technical Writing
> Free Writing

Textbooks:

1. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication: Principles and Practice*. 2nd ed. Oxford University Press (2011).
2. Gardner, Peter S. *New Directions: Reading, Writing and Critical Thinking.* 2nd ed. Cambridge University Press (2005).

Course Title	**: Math-II**	
Course No	**: HCAC-153**	**Credit Hours: 3**
Year/Semester	**: I/II**	**Full Marks: 60+40**
Nature of course	**: Theory+ Practical**	**Pass Marks: 24 + 16**

Course Objectives:

The objective of this course is to establish sound mathematical background of calculus, mathematical reasoning, linear programming and system of linear equations to develop skills in pursuing easier and better methods to solve problems related to computer application courses.

Course Content:

UNIT I: Symbolic Logic and Linear Programming [7 Hrs.]

Statements: simple and compound; Conjunction, Disjunction, Conditional, Bi-conditional and Negation with truth tables; Compound statements using: unless, either…or, neither…nor and their truth tables; Equivalence of compound statements; Tautology, Contradiction and Contingency; Negations of conditional and bi-conditional rules; Laws of algebra of statements and Laws of logic.

Basic concepts and terminology of Linear Programming; Formation of LPP, Standard and canonical forms of LPP; Graphic, Simplex and Dual methods of solving LPP (problems up to 3 variables).

UNIT II: System of Linear Equations [6.Hrs.]

Fundamental concepts of Systems of Linear equations; Diagonally dominant systems; Consistent and inconsistent systems; Test of consistency using rank (without proof); Gauss elimination, Row equivalent, inverse matrix (using adjoint and Gauss-Jordan), Gauss-Seidel Methods of solving system of Linear equations.

UNIT III: Limit and Continuity [6 Hrs.]

Meanings of symbols of +ve and –ve infinites and their properties; Indeterminate forms; Concepts of Limit of a function, left and right hand limits, Conditions for existence of limit at a point, Properties of limits (without proof), evaluation of limits of algebraic, trigonometric, exponential and logarithmic functions; Continuity and its geometrical meaning; conditions for a function to be continuous and Location of discontinuity; Related problems.

UNIT IV: Derivative [8 Hrs.]

Increments; Concept of derivative, Rules of differentiations: Constant rule, Constant multiple rule, Power rule, Sum rule, Product rule, Division rule, Chain rule, Parametric, General power rule and Implicit rule (without proofs); Problems of finding derivatives of algebraic, trigonometric, exponential and logarithmic functions; Higher ordered derivatives.

UNIT V: Applications of Derivatives [8 Hrs.]

Derivative as slope and rate measure; Use of L' Hospital rule to evaluate limit; Monotonicity and Concavity of curves of functions; Stationary and Inflectional points; Global and Local extrema; Conditions for a function to have local extrema; Applications of theory of Extrema in optimizations and risk management of social, commercial and engineering related algebraic functions.

UNIT VI: Antiderivative and its applications [10 Hrs.]

Concepts of Indefinite integrals, Rules and techniques of integrations; Fundamental Theorem of Integral Calculus (without proof) and Definite integrals; Evaluations of definite and indefinite integrals.

Applications of definite integration in Quadrature and Rectifications of plane regions bounded by simple standard algebraic curves; Evaluation of surface area and volume of solid of revolution of standard algebraic curves.

Practical work:

For technical computing "MATLAB" is used. It incorporates visualization, computation, and programming in a practical environment where by mathematical notation problems and solutions are expressed. To explain above topic MATLAB should be used to for practical demonstration.

Reference books:

1. Koirala SP, et al. **Integral Calculus,** Vidyarthi Pub Ltd
2. Gohiwar, CN et al. **Foundations of Mathematics,** Asmita publication.
3. Budnick, F S. **Applied Mathematics for Business Economics and Social Sciences,** McGraw-Hill Ryerson Ltd.

Course Title   : C++Programming

Course no: HCAC-154	**Credit Hours : 4**
Year /Semester: I/II	**Full Marks: 60+20+20**
Nature of Course: Theory + Practical	**Pass Marks:24+8+8**

Course Objectives:

- The objective of this course is to differentiate between OOP and Procedural Programming. Students will be able to make acquainted with Object Oriented Concept, to introduce the fundamentals of C++
- To enable the students to solve the problems in Object Oriented technique. Students are capable to decompose the problem into a set of objects and to cope with features of Object Oriented Programming

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Course contents:

UNIT I: OOP basics   [9 Hrs.]

Introduction:Basic Concept of OOP,differentiate between Procedural Programming and OOP,Benefits of OOP, Object &Class, Data Abstraction, Data Encapsulation, Data Hiding member functions, Reusability, Inheritance, creating new Data Types, Polymorphism, Overloading, Dynamic binding and Message passing.

C++ Features: the iostream class, C++ Comments, Tokens, Keywords and Identifiers, Variable declaration, the const Qualifier. The endl, Set Waste precision, Manipulators, Operators in C++,The scope resolution operator, The new & delete Operations., Implicit Conversion, Control Structure in C++.

Functions: Simple Functions, Function declaration, calling the function, function definition, passing argument to, returning value from function, passing constants, Variables, pass by value, passing structure variables, pass by reference, Default arguments, return statements, return by reference, overloaded functions; Different number of arguments, Different Kinds of argument, Static Data Member and Static Function,inline function.

UNIT II: Classes and Objects   [10 hrs.]

Objects & Classes: Classes & Objects, Class Declaration, Class member; Default Constructor, Parameterized Constructor and Copy Constructor, Destructors, Member functions, Class member visibility, private, public, protected.

The scope of the class objects constructions, Overloaded constructor, Objects as arguments returning objects from functions, class conversion, manipulation private Data members.
Destructors classes, object & memory, arrays as class member data: Array of objects, Pointer to Objects and Member Access, this pointer, string as class member.

UNIT III: Overloading and Inheritance   [10 Hrs.]

Operator Overloading:Syntax of Operator Overloading, Overloading unary operator: Operator Keyword, Operator arguments, Operator return value, , overloading binary operator, arithmetic operators, comparison operator, arithmetic assignment operator, data conversion; conversion between objects of different classes, Operator Overloading with Member and Non Member Functions

Inheritance: Derived Class & Base Class: Specifying the Derived class accessing Base class members, the protected access specifier, Derived class constructor, Overriding member functions, public and private inheritance; Access Combinations, Classes & Structures, Access Specifiers. Multilevel inheritance, Hybrid inheritance, Multiple inheritance; member functions in multiple inheritance, constructors in multiple inheritance, Containership; Classes, within classes, Inheritance & Program development.

UNIT IV: Pointers   [8 Hrs.]

Addresses and pointers: The Address of Operator, Pointer Variables, Syntax Quibbles, Accessing the Variable pointed to , Pointer to void, Pointer and Arrays, Pointers and Functions, Pointers to Objects, Linked List Example: A chain of pointers, Adding an Item to the list, Displaying the List Contents, Pointer to Pointer,

UNIT V: Virtual Function and polymorphism   [8 Hrs.]

Virtual Function: Normal Member Functions Accessed with Pointers, Virtual Member Function Accessed with Pointers, Dynamic binding Late Binding, pure virtual functions
Friend Function: Friends as Bridges, Breaching the Walls, friends for functional Notation, friend Classes

Static Function: Accessing static Functions, Numbering the Objects, Investigating Destructors

This Pointer: Accessing Member Data with this, using this for Returning values, Revised STRIMEM program,

UNIT VI: Templates & Exception Handling   [7 Hrs.]

Templates & Exception Handling: Introduction to Exception &Templates, Class Templates, function templates, Member function templates, Overloading Function Templates, Template arguments, Exception Handling: Exception handling mechanism: try,catch block, throw statement, Multiple Exception Handling, Handling Uncaught and Unexpected Exceptions.

UNIT VII: I/O Stream   [8 Hrs.]

Input/output: Stream based input/output, input/output class hierarchy, Testing Stream Errors, Unformatted Input/Output, Formatted Input/outputand File input/output, File Stream Class Hierarchy, File Access Pointers and their Manipulators, Sequential and Random Access to File, Testing Errors during File Operators

Project

Preparation of small project using C++ with the feature of input, process, output and store in external file.

Laboratory work:
1. Functions & Recursion.
2. Inline Functions.
3. Programs to Understand Different Function Call Mechanism.
    a. Call by reference & Call by Value
4. Programs to Understand Storage Specifiers.
5. Constructors & Destructors.
6. Use of "this" Pointer. Using class
7. Programs to Implement Inheritance and Function Overriding.
8. Multiple inheritance –Access Specifiers
9. Hierarchical inheritance – Function Overriding /Virtual Function
10. Programs to Overload Unary & Binary Operators as Member Function & Non Member Function.
11. Programs to Understand Friend Function & Friend Class.
12. Programs on Class Templates
13. Use Exception handling example
14. Program to use Stream Console and File Input/Output.

Text books:
1. Lafore Robert, "Object Oriented Programming in Turbo C++", Galgotia
2. E. Balaguruswamy: Object Oriented Programming with C++, Tata McGraw Hill

Reference:
1. Lippman, "C++ Primer", 3rd Edition, Pearson Education, 2010.
2. Farrell, "Object Oriented Programming Using C++", 1st Edition 2008, Cengage Learning India.
3. NavajyotiBarkakati, "Object-Oriented Programming in C++" Prentice Hall of India
4.Venugopal, Rajkumar & Ravishankar, "Mastering C++" Tata Mc Graw Hill Publication, India

Course Title: Operating System
Course no: HCAC-155   Credit Hours: 3
Year /Semester: I/II   Full Marks: 60+20+20
Nature of course: Theory + Practical   Pass Marks: 28+8+8

Course objectives:

- The objective of this course is to help students become familiar with the fundamental concepts of operating systems and provide students with sufficient understanding of operating system design.
- To develop both practical and theoretical concepts of process, memory, storage, and I/O management and apply a mature understanding of operating system design and how it impacts application systems design and performance.

Course contents:

UNIT I: Introduction: [8 hrs.]

Introduction to Operating System, Operating System services, System: Desktop Systems, Multiprocessor Systems, Distributed Systems, Clustered Systems, Real- Time Systems.

Computer-System Structures: Operation, I/O Structure, Storage Structure, Storage Hierarchy. System Components; Operating-System Services; System Calls; System Programs; System Structure, System Design and Implementation, System Generation.

UNIT II: Processes   [10 hrs.]

Process Concept; Process Scheduling, Process State, Process control and transition, Operations On Processes, Cooperating Processes, Threads and Inter-Process Communication, Thread module, Process synchronization.

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms: FCFS, SJF, Round Robin & Queue Algorithms, Priority Scheduling

Deadlocks: Deadlock characterization, Methods for handling deadlocks, Resource Allocation Graphs, Banker's Algorithm

UNIT III: Memory Management: [8hrs.]

Memory Management- Backward, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory

Virtual Memory: Demand paging, Performance of demand paging, Page replacement, Page replacement algorithms, Thrashing.

UNIT IV: File management: [8 hrs.]

File-System Structure; File-System Implementation; Directory Implementation; Allocation Methods, Free-Space Management, File Input Output Management.

Mass-Storage Structure: Disk Structure; Disk scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.; Disk Management; Swap- Space Management, Device Independence

UNIT V: Protection & Linux system   [12 hrs.]

Goals of Protection; Domain of Protection; Access Matrix; Implementation of Access Matrix; Revocation of Access Rights, Security and System Administration.

The Linux System: History; Design Principles; Kernel Modules; Process Management; Scheduling; Memory Management; File Systems; Input and Output; Security.

Laboratory works: Each student be consigning to make obvious Linux commands, demonstrate process creation and thread creation, Simulate Processor Scheduling and deadlock detection algorithms, Simulate the process synchronization mechanisms, concept of virtual memory, Demonstrate Directory and File Attributes, Simulate Disk scheduling algorithms and file management techniques

Textbooks:
1. Andrew S. "**Tanenbaum, Modern Operating Systems** ", Prentice-Hall.

References:
1. Silberschatz, "Galvin and Gagne, **Operating System Concepts**", Addition Wesley.
2. Harvey M. Deitel, "Operating Systems", Second Edition, Pearson Education Pvt. Ltd.

Course Title: Financial Accounting
Course no: HCAC-201   **Credit Hours: 3**
Year /Semester: II/III   **Full Marks: 60+20+20**
Nature of Course: Theory + Practical   **Pass Marks: 24 + 8 + 8**

Course objectives:

- The objective of the **Financial Accounting** program is to provide the student with opportunities to acquire and apply the knowledge of business concepts and office skills to meet the demands of today's business environment.

Course contents:

UNIT - I: INTRODUCTION   [11 Hrs.]

Meaning and nature of accounting, Scope of financial accounting, Interrelationship of Accounting with other disciplines, Branches of Accounting

Conceptual Frame work: Accounting Concepts, Principles and Conventions, Accounting Standards-concept, objectives, benefits, brief review of Accounting Standards in Nepal, Accounting Policies, Accounting as a measurement discipline, valuation Principles, accounting estimates.

UNIT - II: Recording of transactions   [12 Hrs.]

Voucher system; Accounting Process, Journal, Rules of Debit and Credit, Sub Division of Journal: Cash Journal, Subsidiary Books, Petty Cash Book, Purchase Journal, Purchase Return, Sales Journal, Sales Return Journal, Ledger, Trial Balance, Bank Reconciliation Statement.

UNIT - III: Preparation of final accounts: [11 Hrs.]

Preparation of Final Accounts, Trading Account, Profit & Loss Account, Balance Sheet-Without adjustments and with adjustments.

UNIT - IV: Inventory and Deprecation   [11 Hrs.]

Meaning of Inventory, Objectives of Inventory Valuation, Inventory Systems, Methods of Valuation of Inventories-FIFO, LIFO and Weighted Average Method
Concept of Deprecation, Causes of Depreciation, Meaning of Depreciation Accounting, Method of Recording Depreciation, Methods of Providing Depreciation.

UNIT - V: Introduction to Company Accounts   [11 Hrs.]

Meaning of Company, silent Features of Company, and types of company. Preparation of Financial Statements, Share Capital and its types. Debentures and its types, Distinction between Debentures and shares, Issues of Shares and Debentures, Redemption of Preference Shares.

Laboratory work (Computerized Accounting):

Accounting Software packages like Tally can be implemented for practical works of above-mentioned topics to make student acquisitioned with computerized accounting entries and preparing report.

Text Book

1. Madhav Raj Koirala, L P Bhanu Sharma, Narendra Sharma, Chiranjibi Acharya, Chinta M. Gautam, **Financial Accounting**, 2nd edition, Buddha Academic Publishers and Distributors P Ltd, Kathmandu

Suggested References

1. Porter, Gary A. and Norton, Curtis L., **Financial Accounting: The Impact on Decision Makers**, Harcourt College Publishers, Orlando
2. Narayanswamy, R., **Financial Accounting: A Managerial perspective**, 10 editions, PHI (P) Ltd., New Delhi
3. Y R Koirala, R P Acharya, D Bhandari, M Karmacharya, B B Sharma, **Introduction to Financial Accounting**, 2012, Asmita Books Publishers & Distributors, Nepal.

Course Title: Data Structures & Algorithm
Course Code: HCAC-202
Year / Semester: II/III
 Nature of course: Theory + Lab

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

Course Objectives:

- The objective of this is course is to introduce and make able to implement the data structures and algorithms. Identity the time and space complexity of different algorithms.
- To achieve these goals, it includes chapters Introduction, Stack, Queues, Linked List, Recursion, Tree, Graph, Searching and Sorting.
- Course emphasis not only on theoretical portion of subject domain but also highly focuses on practical implementation of data structures and algorithms.

Course Contents:

UNIT - I: Introduction to Data Structures & Algorithms   [5 hrs.]

Data types, Data structure and Abstract date type, Dynamic memory allocation in C, Introduction to Algorithms, Asymptotic notations and common functions

UNIT - II: Stacks   [5 hrs.]

The Stack: Introduction, definition, primitive operation, the stack as an abstract data type, implementing the Stack operation.

The Infix, Postfix & Prefix: Introduction, evaluating the postfix operation, program to evaluate the postfix operation, limitation of program, converting from one to another.

UNIT - III: Queues   [5 hrs.]

Definition, Queue as an ADT, Primitive operations in queue: Enqueue and Dequeue, Linear Queue, Circular Queue, Priority Queue.

UNIT - IV: Lists   [6 hrs.]

List and ADT, Array Implementation of Lists, Types of Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, Basic operations in Linked List: creation, node insertion and deletion from beginning, end and specified position, Stack and Queue as a Linked List

UNIT - V: Recursion   [4 hrs.]

Principle of recursion, Comparison between recursion and iteration, Factorial, Fibonacci sequence, GCD, Tower of Hanoi(TOH), Applications and Efficiency of recursion

UNIT - VI: Trees   **[5 hrs.]**

Concept and definitions, Basic operations in binary tree, Tree height, level and depth, Binary Search Tree, Insertion, Deletion, Traversals (pre-order, post-order and in-order), Search in BST, AVL tree and Balancing algorithm, Applications of tree

UNIT - VII: Sorting   **[5 hrs.]**

Introduction and Types of sorting: Internal and External sort, Comparison Sorting Algorithms: Bubble, Selection and Insertion Sort, Divide and Conquer Sorting: Merge, Quick, Heap Sort, radix sort and Shell sort, Efficiency of Sorting Algorithms

UNIT - VIII: Searching   **[5 hrs.]**

Introduction to searching, Search Algorithms: Sequential search, Binary search, Efficiency of search algorithms, Hashing: Hash function and hash tables, Collision resolution technique

UNIT - IX: Graphs   **[5 hrs.]**

Definition and Representation, Graph Traversal: BFS and DFS, Minimum Spanning Trees: Kruskal and Prims Algorithm, Shortest Path Algorithms: Dijksrtra Algorithm

Laboratory work:

Laboratory work can be implemented either using C or C++.
1. Write a program to implement stack operations.
2. Write a program to implement queue operations.
3. Write a program to implement singly, singly circular and doubly linked list operations
4. Write a program to implement stack and queue as linked list
5. Write a code to convert any prefix number to postfix.
6. Write a code to convert any infix number to postfix.
7. Write a code to convert any post fix number to prefix.
8. Implement tower of Hanoi.
9. Write a code to implement different sorting techniques.
10. Write a code to demonstrate the binary search

Text book:
1. G. S. Baluja, "*Data structure Through C, A Practical Approach*", Fourth Ed. Dhanpat Rai & Co., 2009-10.
2. Seymour Lipschutz, "Data Structures with C", Schaum's outLines, Tata McGraw-Hill, 2011.

REFERENCE BOOKS:
1. S.Sahni- Data Structures, Algorithms and Applications in C++, 2nd Edn. Universities Press, India, 2005.
2. Y Langsam , MJ , Augenstein and A.M , Tanenbaum Data Structures using C and C++ , Prentice Hall India.
3. M.Litvin & G.Litvin- Programs with C++ and Datastructures-Vikas Publishing Home, New Delhi

Course Title: Microprocessor & Assembly language
Course no: HCAC-203   **Credit hours: 3**
Year / Semester: II/III   **Full   Marks:**
60+20+20
Nature of course: Theory + Lab   **Pass Marks: 24+8+8**

Course Objectives:

- This course explores architecture of a microprocessor and its programming in assembly language.
- The student will be able to apply logics to various given problems and develop programs using assembly language construct that would help them to develop microprocessor-based application programs

Course Contents:

UNIT- I: Introduction of Microprocessor   [6 hrs.]

Microprocessor and Microcontrollers, Evolution of microprocessor and its types, Microprocessor Bus organization: Data Bus, Address Bus and Control Bus, Machine Language, ASCII Code, Writing and Executing Assembly Language Program, Introduction to 8085 microprocessors, Internal Architecture of 8085 and its working, Pin diagram of 8085, Internal registers organization of 8085, Flags in 8085, Limitations of 8085

UNIT- II: Instruction Cycle and Timing Diagram   [6 hrs.]

Instruction cycle, machine cycle, fetch cycle and execution cycle, 8085 machine cycle and bus timings to fetch, decode and execute instruction from memory, Memory read and write, Input/output read and write cycle with timing diagram, **Timing** diagrams of LDA, MOV, MVI, ADD, CALL instructions

UNIT – III   8085 Instruction set   [7 hrs.]

Machine language instruction format: Single byte, two bytes, three-byte instructions, Various addressing modes, Data transfer operation and instruction, Arithmetic operation and instruction, Logical operation and instruction**,** Branch operation and instruction, Stack operation and instruction, Input/output and machine control operation and instruction, Simple programs with 8085 instruction

UNIT – IV: Programming with 8085.   **[10 hrs.]**

Looping, Counting and indexing, Counter and Timing delays, Stack and subroutine basic concepts, Procedure and macro, Delay Routines

UNIT - V: Basic I/O, Memory R/W and Interrupt operations   [5 Hrs.]
Memory devices and classification, Memory mapped I/O, I/O Mapped I/O, Address

decoding: - Unique and non-unique address decoding, Address decoding for I/O and memory, Memory Interfacing, Direct memory access ,8237 DMA controller, Transfer Modes of 8237, Interrupt: -8085 Interrupts and its need, Mask able and non-mask able interrupts, 8085 vectored interrupts, Restart and software instructions, 8259 Programmable Interrupt Controller, Priority modes of 8259

UNIT - VI: Input/output Interfaces   [5 Hrs.]

Parallel Communication: - Introduction and Applications, Serial communication: - Introduction and Applications, 8255 Programmable peripherals interface, 8251   USART, RS-232 Introduction, pin configuration and functions of each pin, Interconnection between DTE-DTE and DTE-DCE

UNIT –VII: Introduction to 8086 Microprocessor   [6 hrs.]

Block diagram - Architecture of 8086l, Register organization of 8086, Concepts of Instruction pipelining, Memory segmentation, Memory address generation, Minimum and Maximum mode operation and diagram, Addressing modes, Flags

Laboratory work
The lab work should include at least:
1. Demonstration of 8085 kit
2. Implement program to perform arithmetic operations (Add, subtract, multiply and divide) on signed and unsigned two 8 bit numbers.
3. Implement a program to mask the lower four bits of content of the memory location.
4. Implement a program to set higher four bits of content of the memory location to 1.
5. Implement a program to perform Exclusive OR of two numbers.
6. Implement a program to exchange the content of two memory locations.
7. Implement program to add/subtract/mul/divide 16 bit numbers
8. Implement program to copy content of one memory location to another memory location.
9. Implement a program to find the factorial of a number, generate Fibonacci series
10. Implement a program to count no of zero value in given block of data.

Text book:
1. Ramesh Gaonkar, Microprocessor Architecture, Programming, and application with 8085, Penram International Publication.
2. K. R. Venugopal & Rajkumar, Microprocessor x86 programming, BPB Publication, 2007.

Reference Books:
1. A.P.Malvino and J.A.Brown, Digital Computer Electronics, 3rd Edition, Tata McGraw Hill D.V.Hall, Microprocessors and Interfacing– Programming and Hardware, McGraw Hill
2. 8000 to 8085 Introduction to 8085 Microprocessor for Engineers and Scientists, A.K.Gosh, Prentice Hall
3. John Ufferbeck, The 8080/85 Family: Design, Programming & Interfacing, PHI India.
4. A. K. Ray & K. M. Bhurchandani, Advance Microprocessor and Peripherals, 2nd Edition, Tata McGraw Hill.

Course Title: Computer Oriented Numerical Methods
Course no: HCAC-204   Credit hours: 3
Year / Semester: II/III   **Full Marks: 60+20+20**
Nature of course: Theory + Practical   **Pass Marks: 24+8+8**

Course Objectives:

- The general objective of this course is to provide theoretical knowledge and practical skills required for mathematical modeling of linear and non- linear algebraic equation, interpolation and curve fitting, numerical differentiation and numerical integration using different methods.

Course Contents:

UNIT I: Numerical Computing and Computing Errors   [5 Hrs.]

Numerical Computing: Introduction, Process, Characteristics: Accuracy, Rate of Convergence, Numerical Stability, Efficiency; Computational Environment, New Trends in Numerical Computing.

Computing Errors: Introduction, Significant Digits, Inherent Errors, Numerical Errors, Modeling Errors, Blunders, Absolute and Relative Errors, Error Estimation, Minimizing Error.

UNIT II: Solving Nonlinear Equations   [8 Hrs.]

Introduction: Algebraic, Polynomial and Transcendental Equations; Methods of Solutions; Iterative Methods; Starting and Stopping an Iterative Process; Bisection Method with Convergence; False Position Method with Convergence; Newton-Raphson Method with Convergence and Limitation; Secant Method with Convergence; Fixed Point Iteration Method with Convergence.

UNIT III: Interpolation and Curve Fitting   [8 Hrs.]

Introduction, Polynomial Forms, Linear Interpolation, Difference between Interpolation and Extrapolation, Lagrange's Interpolation Method, Newton's Interpolation Method using Divided Difference Table, Forward Difference Table and Backward Difference Table, Fitting Linear Equation: Least Square Regression, Fitting a Polynomial Function.

UNIT IV: Numerical Differentiation and Integration   [8 Hrs.]

Numerical Differentiation: Need and Scope, Differentiating Continuous Functions using Forward difference quotient and Central difference quotient, Differentiating Tabulated Functions; Numerical Integration: Need and Scope, Numerical Integration by Trapezoidal Rule, Simpson's 1/3 Rule and Simpson's 3/8 Rule.

UNIT V: Solving Linear Equations   [8 Hrs.]

Elimination Approach: Need and Scope, Existence of Solution and Properties of Matrices, Guess Elimination Method (Basic and with Pivoting), Gauss Jordan Method, Triangular Factorization Method; Iterative Method: Need and Scope, Jacobi Method, Gauss Seidel Method.

UNIT VI: Solving Differential Equations   [8 Hrs.]

Introduction to Ordinary Differential Equation, Initial Value Problem, Taylor Series Method, Picard's Method, Euler's Method, Heun's method, Runge-Kutta Methods, Solution of Higher Order Equations, Boundary Value Problems, Shooting   Method.

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

Laboratory Work

Laboratory work should consist of program development and testing of Non-linear Equations, Interpolation, Numerical Differentiation, Numerical Integration and Linear Equations using C / C++Builder / Python or any appropriate programming language platform. Separate laboratory report should be submitted for each lab applicable unit on individual basis.

Text Books:

1. W. Chency and D. Kincaid, *Numerical Mathematics and Computing*, 7thEdition, Brooks/Cole Publishing Co, 2012.
2. E. Balagurusamy, *Numerical Methods*, Tata McGraw Hill Education Private Ltd, New Delhi.

Reference Books:

1. T. A. Beu, *Introduction to Numerical Programming using Python and C/C++*, CRS Press, 2015.
2. S.S. Sastry, *Introductory Methods of Numerical Analysis,* 5th Edition, PHI Learning Pvt. Ltd., New Delhi.
3. B. S. Grewal, *Numerical Methods in Engineering & Science (C, C++ & MATLAB),* Mercury Learning & Information, 2018

Course Title: Data communication and Computer Networking

Course Code: HCAC-205	**Credit hours: 3**
Year / Semester: II/III	**Full Marks: 60+20+20**
Nature of course: Theory + Lab	**Pass Marks: 24+8+8**

Course Objectives:

- The objective of this course is to set the skill and knowledge of basic networking and data communication theories to students. It is divided into two sections: Data communication and Computer networking.
- The course is focuses on theoretical knowledge as well as practical skills of the discipline.

Course Contents:

UNIT I: Introduction to data communication and computer networking   [6 Hrs.]

Data Communication Concept, Parallel & Serial Transmission, Data Transmission modes, Computer Networks, Networking Devices and Protocols, Network Types, LAN Topologies, OSI Reference Model, TCP/IP Protocol Suit.

UNIT II: Physical Layer   [7 Hrs.]

Functions of Physical Layer, Data & Signals, Properties of Analog and Digital Signals, Digital Signal Transmission, Analog signal Transmission, Transmission Impairment, Data Rate, Performance, Multiplexing, Transmission media.

UNIT III: Data Link Layer   [8 Hrs.]

Functions of Data Link Layer, Error Detection and Correction, Data Link Control: DLC Services, Data Link Layer Protocols, HDLC, PPP. Media Access Control (MAC), Wired & Wireless LANs.

UNIT IV: Network Layer   [10 Hrs.]

Functions of Network Layer, Network Layer Protocols, IPv4 Address, Address Space, Classful Addressing, Classless Addressing, Subnetting, Network Address Translation (NAT), Unicasting, Multicasting, Broadcasting, Routing Algorithms, Routing Protocols. Introduction to IPv6.

UNIT V: Transport Layer   [5 Hrs.]

Functions of Transport Layer, Connectionless vs connection-oriented services, Transport Layer Protocols: TCP and UDP.

UNIT VI: Application Layer   [5 Hrs.]

Function of Application Layer, Application Layer Protocols: DNS, DHCP, HTTP, WWW, FTP, SMTP, POP, IMAP, TELNET. Network Traffic Analyzers.

UNIT 7: Network Security   **[4 Hrs.]**

Security Requirement, Data encryption strategies, authentication protocols, Firewalls.

Laboratory works:
1. Construct straight and cross cable for communication.
2. Implement the LAN topologies.
3. Configure the IP address of the computer.
4. Create a network to share file and folders.
5. Implement the IP subnetting.
6. Install and configure Windows/Linux server.
7. Configure basic DNS and DHCP Services in Windows/Linux Server
8. Analyze the network traffic using any network traffic analyzing tool.

Text Book:

1. Behrouz A. Forouzan, "Data Communications and Networking" , 5th Edition, Tata McGrawHill
2. William Stallings, "Data and Computer Communications", Pearson Education Low Price Edition.

Reference Book:

1. James F Kurose and Keith W Ross Computer Networking, A Top-Down Approach, sixth edition , persion, 2017

Course Title: Java Programming
Course no: HCAC-251   **Credit hours: 3**
Year / Semester: II/IV   **Full Marks: 60+20+20**
Nature of course: Theory + Lab   **Pass Marks: 24+8+8**

Course Objectives:

• HCAC-251 course main objective is to give fundamentals knowledge of Programming such as variables, conditional and iterative execution and methods. Students get knowledge of OOP paradigm in Java and familiar with the features of Java Language.

• To discover how to write Java in variety of technologies on different platforms. Students use concepts such as Classes, Objects, Inheritance, Polymorphism and Interfaces.

Course Contents:

Unit - I: Introduction to Java   [6 Hrs.]

History and features of Java, setting java path, JDK, JRE, and JVM, understanding the semantic and syntax differences between C++ and Java, compiling and executing a java program, Identifiers, variables, constants, keywords, literals, Primitive data types, Operators (arithmetic, logical and bitwise) and Expressions, comments, doing basic program output, flow control structure(conditional statements, loops) and nesting, Java methods (defining, scope, passing and returning arguments, type conversion and type and checking, built-in java class methods),

Unit –II: Arrays, Strings   [6 Hrs.]

Introduction to Java Array, Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, for-each loop, length of an Array, increasing and decreasing the size, copy of an array. Java Strings: The String constructors, string length, Special string operators: string literals, concatenation and conversion, String comparison, searching strings, Modifying Strings, String Buffer.

Unit –III : Object-Oriented Programming Overview   [6 Hrs.]

Principles of object-oriented programming, defining & using classes, object, this key word, controlling access specifiers, class constructors, super key word, method overloading, class variables & methods, objects as parameters, final classes, inner class, object class, garbage collection.

Unit IV: Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata [10 Hrs.]

inheritance: (single level and multilevel, method overriding, dynamic method dispatch, abstract classes), interfaces and packages, defining a package, finding packages and CLASSPATH, access protection, interfaces, extending interfaces and packages, package and class visibility, using standard java packages (util, lang, io, net), wrapper classes, autoboxing /unboxing, enumerations and metadata.

Unit V: Exception Handling and Threading   [7 Hrs.]

introduction to exception, exception types, try, catch, finally blocks, uncaught exceptions, throws &throw, built-in exceptions, creating your own exceptions;

multi-threading: introduction to multithreading, the thread class and runnable interface, creating single and multiple threads, thread prioritization, synchronization and communication, suspending/resuming threads. deadlock and its prevention. life cycle of thread. deprecated methods : stop(), suspend(), resume() etc.

Unit VI: Input/output and Stream [6 Hrs.]

concept of streams, stream classes, byte stream classes, character stream classes, using the file class file: directories, using filenamefilter, the listfiles(), creating directories , the autocloseable, closeable, and flushable interfaces , i/o exceptions of the stream classes , the byte streams: inputstream, outputstream, fileinputstream, fileoutputstream, printstream, dataoutputstream and datainputstream, randomaccessfile , the character streams: , reader, writer, filereader, filewriter, printwriter , the console class , serialization: serializable, externalizable, objectoutput, objectoutputstream, objectinput, objectinputstream

Unit VII: Database Connectivity in Java [4 Hrs.]

Introduction to JDBC, JDBC Architecture, types of JDBC Driver, Steps for connectivity to Database, The Statement Objects, MySQL installation and configuration, JDBC- SQL Syntax, prepared statement and callable statement objects, types of resultset.

Lab works:
1. Develop a java program to find Fibonacci numbers
2. Develop a java program sorting number
3. Develop a Java program to display the mark statement with result and grade.
STRINGS AND VECTORS
4. Develop a Java program to implement Method Overloading.
5. Develop a Java Applications to extract a portion of a character string and print the extracted string.
6. Develop a Java program to add, delete list of elements using Vectors.
PACKAGE AND INTERFACES
7. Develop a Java program to create your own package.
8. Develop a Java Program to implement the concept of multiple inheritance using Interfaces.
MULTITHREADING AND EXCEPTIONS
9. Develop a Java Program to implement the concept of multithreading with the use of any three multiplication tables and assign three different priorities to them.
10. Develop a Java Program to create an Exception called payout-of-bounds and throw the exception.
11. Develop a Java Program which open an existing file and append text to that file.
Files
12. Develop a program to insert and retrieve records in Database.
Text books:

- "Programming with JAVA a Primer" by E. Balguruswamy TATA McGraw Hill
- Herbert Schildt, Java: The Complete Reference, Ninth Edition, McGraw-Hill, ISBN- 13: 978-0071808552, ISBN-10: 9780071808552, 2014.

References:
- Bert Bates, Kathy Sierra, Head First Java, Second Edition, O'Reilly Media, Inc, ISBN: 0-596-00920-8, 2005
- Cay S. Horstmann and Gary Cornell, Core java Volume I – Fundamentals, Ninth Edition, Prentice Hall, ISBN-13: 978-0-13-708189-9, ISBN-10: 0-13-708189-8, 2012

Course Title: Database Management System

Course no: HCAC-252
Year / Semester : II/IV
Nature of course: Theory + Lab

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

Course Objectives:

- To impart students with the practical knowledge of DBMS
- To make students able to design a data oriented application.

Course contents:

Unit I: Introduction [4 Hrs.]

Database and Database System, File-based System and its drawback, Database Approach and Database Management System, Advantages of DBMS.

Unit II: DBMS Concepts and Architecture [6 Hrs.]

Data models, DBMS architecture, Data independence, Database languages, Database users and Database administrators, E-R Model : Entity, Attribute, Relationship, Key, Cardinality, E-R Diagram.

Unit III: Relational Model and Algebra [6 Hrs.]

Properties of Relation, Schema, Tuples, Domains, Schema Diagram, Relational Algebra : Select, Project, Union, Intersection, Difference, Product, Join, Rename, Assignment, and Division operations

Unit IV: SQL and Constraints [12 Hrs.]

SQL basics, Structure of SQL statement, SQL Query : DDL, DML, Null Value, String Operation, Aggregate Function, Join, Sub-Query, Set Operation, View, Domain Constraint, Entity Integrity, Referential Integrity.

Unit V: Normalization [6 Hrs.]

Fully Functional Dependency, Partial Dependency, Transitive Dependency, Multi Valued Dependency, Normalization, Normal Forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF.

Unit VI: Database Security [4 Hrs.]

Overview of DB Security, SQL Access for DB security, Access control: Discretionary and Mandatory, Encryption and Decryption, Substitution and Transposition methods.

Unit VII: Transaction Management [7 Hrs.]

ACID Properties. Transaction States, Atomicity, Durability, Serializability, Basics of Concurrency Control and Recovery, Locking Protocol, Time Stamp based Protocol.

Laboratory Works:

- Laboratory classes covering SQL operations
- Laboratory classes covering topics of Integrity Constraints

Course Project:

- Design a database using and RDBMS software like MSSQL server or ORACLE, mySQL etc.

Text Book:

1. C. J. Date, **"Introduction to Database Systems"**, Addison-Wesley
2. Abraham Silberschatz et. al., **"Database System Concepts",** McGraw Hill

References Book:

1. Ramez Elmasri & Shamkant B. Navathe, **"Fundamentals of Database Systems"**
2. Gursharan Singh**, "A Guide to Oracle Developer 2000/Forms**", Khanna Book Publishing Co. P. Ltd.

Course Title: Computer Architecture
Course no: HCAC-253   Credit hours: 3
Year / Semester: II/IV   **Full Marks: 60+20+20**
Nature of course: Theory+ Practical   **Pass Marks: 24+8+8**

Course Objectives:

The students should be able to:

- Comprehend the basic structure and operation of digital computer.
- Comprehend the hardware-software interface.
- Understand the arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
- Understand the concept of pipelining.
- Understand the concept of hierarchical memory system including cache memories and virtual memory.

Course contents:

UNIT -1: Introduction: [2 Hrs.]

Introduction to computer architecture, history of computer architecture, structure of computer, function of computer, languages, levels, and virtual machines, contemporary multilevel machines.

UNIT -II : Computer system organization and Design   [8 Hrs.]

CPU organization, instruction execution, RISC Vs CISC, design principles for modern computers, instruction level parallelism, processor level parallelism, instruction code, operation code, stored program concept, registers and memory of basic computer, common bus system for basic computer, instruction format, instruction set completeness, control unit of basic computer, control timing signals, instruction cycle of basic computer, determining type of instruction, memory reference instructions, input-output instructions, program interrupt & interrupt cycle, flowchart of common computer

UNIT-III: Register Transfer Language and Micro-operations   [5 Hrs.]

Microoperation, register transfer language, register transfer, control function , bus and memory transfers, arithmetic micro-operations, logic micro-operations, shift microoperations, arithmetic logic shift unit.

UNIT-IV: Design of Control UNIT & CPU   [8 Hrs.]

Control word, microprogram, control memory, control address register, sequencer, hardwired control unit, microprogrammed control unit, address sequencing, conditional branch, mapping of instructions, subroutines, microinstruction format, symbolic microinstructions, design of control unit, central processing unit: major components of CPU, CPU organization, instruction formats, addressing modes.

UNIT-V: Pipeline and Vector Processing   [4 hrs.]

Parallel processing, multiple functional units, flynn's classification, pipelining: concept and demonstration with example, speedup equation, floating point addition and subtraction with pipelining, instruction level pipelining: instruction cycle, three & four-segment instruction pipeline, pipeline conflicts

and solutions, vector processing and applications, vector operations, matrix multiplication, memory interleaving.

UNIT-VI: Computer Arithmetic [6 Hrs.]

Fixed point representation, representing negative numbers, floating point representation, arithmetic with complements, overflow, detecting overflow, addition and subtraction with signed magnitude data, addition and subtraction with signed 2's complement data, multiplication of signed magnitude data, booth multiplication, division algorithm (restoring, non-restoring), divide overflow

UNIT – VII: Input-Output Organization: [4 hrs.]

Peripheral devices, input-output interfaces, asynchronous, data transfer, modes of transfer, priority interrupt, direct memory access (dma).input output processor, serial communication.

UNIT-VIII: Memory Organization [8 Hrs.]

Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, cache memory mapping technique, virtual memory, memory management hardware.

Text books:

1. Morris Mano, Computer System Architecture, 3rd Edition, Prentice-Hall of IndiaPrivate Limited, 1999.

References books:

1. WIliam Stallings, Computer Organization and Architecture, 4th Edition, Prentice Hallof India Private Limited, 2001
2. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", Prentice-Hall of India, Pvt. Ltd., Second edition, 2003.

Lab Works:

The laboratory works should include at least following concepts:

- Implement algorithms for computer arithmetic using high level language like C or C++ or Matlab
- Simulate design of different UNITs by using VHDL
- Simulate pipelining by using VHDL

The students should be encouraged to develop an ALU/CU as their mini project

Course Title: System Analysis and Design

Course no: HCAC-254	**Credit hours: 3**
Year / Semester: II/IV	**Full Marks: 60+20+20**
Nature of course: Theory + Practical	**Marks: 24+8+8**

Course Objectives:

- The general objective of this course is to provide concepts related to information systems development in a systematic approach.

Course Contents:

UNIT- I: Fundamentals for System Development   [9 Hrs.]

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

Software Origins

Introduction, system acquisition, reuse

Managing the Information Systems Project

Introduction, managing information systems project, representing and scheduling project plans, using project management software

UNIT – II: Planning   [7 Hrs.]

Identification and Selection of System Development Projects

Introduction, identifying and selecting systems development projects, corporate and information systems planning

Initiation and Planning System Development Projects

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 - III: Analysis   [13 Hrs.]

Determining 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

Structuring System Process Requirements

Introduction, process modeling, data flow diagramming mechanics, using data flow diagramming in the analysis process, modeling logic with decision tables

Structuring System Data Requirements

Introduction, conceptual data modeling, gathering information for conceptual data modeling, introduction to E-R Modeling, conceptual data modeling and E-R Model, representing super-types and sub-types, business rules, role of packaged conceptual data models – database patterns

UNIT – IV: Design   [12 Hrs.]

Databases Designing

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

Forms and Reports Designing

Introduction, designing forms and reports, formatting forms and reports,   assessing usability

Interfaces and Dialogues Designing

Introduction, designing interfaces and dialogues, interaction methods and devices, designing interfaces and dialogues in graphical environments

UNIT- V: Implementation and Maintenance   [4 Hrs.]

System Implementation

Introduction, system implementation, software application testing, installation, documenting the system, training and supporting users, organizational issues in systems implementation

System Maintenance

Introduction, maintaining information systems, conducting systems maintenance

Practical Work

Practical work should consists of handling system analysis and designing activities in a CASE environment, industrial experience sharing sessions conducted by an expert from software industry and development of conceptual design of an information system for an organization of students' choice. A report on conceptual design of an information system should be submitted in a group which consists of not more than three students.

Text Book

1. J. F. George and J. S. Valacich, *Modern Systems Analysis and Design*, Eighth Edition, Pearson Education Inc.,2017.

Reference Books

1. J. Satzinger, R. Jackson & S. Burd, *System Analysis and Design in a Changing World,* Seventh Edition, Cengage Larning, 2016

2. G. B. Shelly & H. J. Rosenblatt, *Systems Analysis and Design*, Ninth Edition, Cengage Larning, 2012

3. A. Dennis, B. H. Wixom & R. M. Roth, *Systems Analysis and Design*, Fifth Edition, John Wiley & Sons, 2012

4. J. Whitten & L. Bentley, "*Systems Analysis and Design Methods*", Seventh Edition , The McGraw-Hill Companies Inc., 2007

Course Title: Discrete Structures
Course No: HCAC-255   **Credit Hours: 3**
Year / Semester: II/IV   **Full Marks   : 60+20+20**
Nature of Course: Theory and Practical   **Pass Marks   : 24+8+8**

Course Objectives:

- The general objective of this course is to introduce basic discrete structures and explore applications of discrete structures in different fields of Computer Science.
- The course aims students to be familiar with concepts of Logic, Number Theory, Relations, Graphs, Trees and Algebraic structures to solve related problems manually as well as using algorithms.

Course Contents:

UNIT-I: Fundamental of Logic and Proof Techniques   **[10 Hrs.]**

Introduction to discrete structures, logic, proposition, logical connectives, english sentences to logical expression; propositional equivalences, different laws of logical equivalences, predicate, quantifiers, free & bound variables, logical equivalences involving quantifiers, rules of inference for propositions and quantified statements and their use in building arguments, fallacies, basic terminologies and different proof techniques (direct proof, indirect proof, proof by contraposition, proof by contradiction and proof by mathematical induction).

UNIT-II: Number Theory   **[5 Hrs.]**

Introduction, Division, The Division Algorithm, Modular Arithmetic, Arithmetic Modulo m, Primes, Trial Division, GCD and LCM, Euclidean Algorithm, Linear Congruences, Computer Arithmetic with Large Integers, Pseudoprimes, Carmichael Number, Primitive roots and Discrete Logarithm, Applications of Congruences: Pseudorandam Numbers, Check Digits;

UNIT-III: Relations   **[7 Hrs.]**

Introduction, Function as a Relation, Relations on a set, Properties of Relations, Combining Relations, n-ary Relations, Operations on n-ary Relations, Applications of n-ary Relations, Matrix and Digraph Representation of Relations, Closures of Relations (Reflexive, Symmetric and Transitive), Equivalence Relations, Equivalence Classes and Partitions, Partial Ordering, Linear Ordering, Lexicographic Ordering, Representation of Poset, Maximal and Minimal Elements of Poset, Lattice, Topological Sorting.

UNIT-IV   : Graphs   **[10 Hrs.]**

Introduction, Applications and Types of Graph; Graph Terminologies, Graph Representation: Adjacency List, Adjacency Matrix and Incidence Matrix; Graph Isomorphism: Introduction and Determining whether Two Simple Graphs are Isomorphic; Graph Connectivity: Path, Circuit, Connectedness in Directed and Undirected Graph, Cut vertices and Cut Edges, Euler's path and circuit, Necessary and Sufficient Conditions for

Euler Circuits and Paths (without proof), Hamilton Path and Circuit, Dirac's and Ore's Theorem (without proof); Shortest Path Problem: Dijkstra's Algorithm; Planer Graph: Introduction, Euler's Formula and Corollaries (without proof), Homeomorphic Graph and Kuratowski's Theorem (without proof); Graph Coloring: Introduction, Four Colour Theorem and Applications.

UNIT-V: Trees [5 Hrs.]

Introduction, tree terminologies, properties of tree (with proof), application of tree: binary search tree; tree traversal: preorder, inorder and postorder traversal; spaning tree: introduction, constructing spanning tree using BFS and DFS algorithm, counting number of spanning tree using Kirchhoff's Theorem; minimal spanning tree: introduction, constructing MST using Kruskal's and Prim's algorithm.

UNIT-VI: Algebraic Structures [8 Hrs.]

Introduction, operations, semigroups, groups, subgroups, normal subgroups, and homomorphisms; rings, internal domains, and fields; polynomials over a field

Practical Work

Laboratory works should consist of program development and testing of all the topics discussed in theory class using Logiccoach (For unit 1) and C / Matlab or any other appropriate programming language platform for the remaining unit. Separate lab report should be submitted for each lab applicable unit on individual basis.

Text Book:

1. Rosen, K.E., *Discrete Mathematics and its Applications*, 7th Edition, McGraw Hill Education Private Ltd, New Delhi.

Reference Books:

1. Garnier, R. and Taylor, J., *Discrete Mathematics: Proof, Structures and Applications,* 3rd Edition, CRS Press.
2. Lipson, M. and Lipschutz, S., *Schaum's Outline of Theory and Problems of Discrete Mathematics*, 3rd Edition, McGraw Hill Education Private Ltd, New Delhi.
3. Singh, Y.N., *Mathematical Foundation of Computer Science*, New Age International Publishers, New Delhi.

Course Title	: Project I	
Course No	**: HCAPJ-256**	**Credit Hours: 2**
Year/Semester	**: II/IV**	**Full Marks: 100**
Nature of course	**: Project**	**Pass Marks: 40**

Course Objective:

- The main objective of this course is to develop both theoretical and practical skills needed to develop real world ready to use software application using suitable software development technique

Course Description:

- This is the first project work of the BCA program that covers different theoretical and practical aspects needed to develop software application that is useful for general public or organizations, focusing specially on different skills including planning, analysis, design, and implementation activities.
- The project can be done in a group preferably with **FOUR / FIVE** members in each group. Students are highly recommended to work in group projects as group projects help them develop a host of skills that are increasingly important in the professional world. Positive group experiences, moreover, have been shown to contribute to student learning, retention and overall success. A supervisor is assigned to supervise each student during project in the college.

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Phases: The overall project work is divided into **TWO** phases:
1. Proposal Submission and Presentation
2. Final Report Submission and Presentation

1. Proposal Submission and Presentation:
- The project team prepares proposal document in the prescribed format and submits to the college
- The panel coordinated by Head / Program Coordinator evaluates the proposal along with presentation from the student(s)
- If the proposal is accepted, a supervisor is assigned by the HOD / Program Coordinator depending upon the nature of the project

2. Final Report Submission and Presentation:
- After submitting the final project report prepared in the prescribed format, the Project team has to present their final project in front of Head / Program Coordinator, Supervisor, Internal Evaluator and External Evaluator.

Proposal Contents:

- Title Page
- Introduction
    - Introduction
    - Problem Statement
    - Objective
    - Scope and limitation
- Methodology
    - Requirement Identification and Feasibility Study
    - Related Work / Literature Review
    - Analysis and Design Tools
    - Implementation tools (Front End, Back End)
- Expected Outcome
- Project Schedule
- References / Bibliography

Report Contents:

- Title Page
    - A standardized page for specifying the title and author of the work
- Certificate of Authorship
    - Declaration that the work reported is the original work
- Approval Sheet
    - Recommendation for approval from Head / Program Coordinator, Supervisor, External and Internal evaluators
- Acknowledgements
    - Thanking anyone who has helped you in any way
- Abstract
    - Giving a short overview of the work
- Table of Contents
    - Giving page numbers for all major section headings
- List of Figures
    - Giving page numbers for all the figures
- List of Tables
    - Giving page numbers for all the tables
- List of Abbreviations
    - List of abbreviations
- Introduction (Chapter I)
    - Introduction: Introduce the organization (if any) and the work
    - Problem Statement: Explain why you are doing this work and what is the problem being solved
    - Aims and Objectives: Clearly explain aims and objectives and scope of your work
    - System Development: Explain in brief about systems development, systems development methodology, and alternative approaches
    - Report Organization: Explain in brief about organization of your report
- Related Work / Literature Review (Chapter II)
    - Explain the current state of the art in your area

- o Explain the works other have people done (published or commercial) that is relevant to yours
- Analysis (Chapter III):
  - o Determining system requirements and studying feasibility
  - o Chose suitable approach (structured or object-oriented)
- Design (Chapter IV)
  - o Convert analysis document into design specifications
- Implementation (Chapter V)
  - o Coding: Design specifications are turned into working computer code using suitable programming language, database technology, and interfacing technology
  - o Testing: Tests are performed using various strategies; A master test plan is developed during the analysis phase; During the design phase, *unit*, *system* and *integration* test plans are developed; The actual testing is done during implementation
- Conclusion and Future Work (Chapter VI)
  - o Explain what conclusions you have come to as a result of doing this work and any future plan to extend the work
- References / Bibliography:
  - o Provide a list of papers, books and other publications that are explicitly referred to in the text
  - o Use IEEE citation style
- Appendices:
  - o Supplementary material should be included in appendices - these are optional, but they might contain:
  - o Code listings – A listing of the code you have written for the project. You should NOT include code listings for code you have not written!! If your project involves modifying code previously written by others, then you may include this other code as long as you indicate clearly in the code listing what parts have been written by you.
  - o Raw data – If your work involves data collection then this should usually be included in appendices. This should provide supporting evidence for claims made in the main part of the work (e.g., copies of a user evaluation questionnaire and some sample responses).
  - o Examples of test data
  - o Electronic material on a CD/DVD/Pen Drive inside the back cover. This might contain executable software, source code, graphics, slides used for your presentation, etc. Where the appendices are long (e.g. code listings) do not print them out, rather provide them on a CD/DVD/Pen Drive

Report Format:
- Page Number
  The pages containing certificate of approval to the page containing list of abbreviations should be numbered in roman starting from i. The pages starting from Chapter 1 onwards should be numbered in numeric starting from 1. Page numbers should be inserted at the bottom of the page and aligned centre.
- Paper Size and Margin
  The paper size should be A4 and the margins must be set as:
  - o Top = 1 in (2.54 cm)
  - o Bottom = 1 in (2.54 cm)

- o Left = 1.25 in (3.17 cm)
- o Right = 1 in (2.54 cm)
- Paragraph
  All paragraphs must be indented and justified (both left-justified and right-justified). All the paragraphs must be written using Times New Roman font with font size 12 and 1.5 paragraph spacing.
- Heading
  No more than 3 levels of headings should be used. Font size for the heading should be 16 for chapter title, 14 for section headings and 12 for subsection headings. All the headings should be bold faced.
- Figures and Tables
  Figure captions should be centred below the figures and table captions should be centred above the table.

Evaluation:

Head / Program Coordinator, Supervisor, Internal and External evaluators will evaluate the overall project work. External evaluator will be assigned only for the final defense.

Marks Allocation:
- Supervisor – 60
- Internal Evaluator – 10
- Head / Program Coordinator – 10
- External – 20

Total – 100

Weight of each Phase:
- Proposal Submission and Presentation - 20%
  - o Evaluated by Head / Program Coordinator (4 Marks), Supervisor (12 Marks), and Internal (4 Marks)
- Final Report Submission and Presentation - 80%
  - o Evaluated by Head / Program Coordinator (6 Marks), Supervisor (48 Marks), Internal evaluator (6 Marks), and External evaluator (20 Marks)

Text Books: None

Prerequisite: Depending upon types of project

Course Title: E- Governance
Course no: HCAC-301   **Credit hours: 3**
Year / Semester: III/V   **Full Marks: 60+20+20**
Nature of course: Theory + Practical   **Marks: 24+8+8**

Course Objectives:

Electronic Governance (e-Governance) seeks to transform public service delivery and citizens' participation in government decision processes for both social and economic benefits.

- This course familiarizes the students with the concept of e-Governance.
- This course aims to provide a basic understanding of e-governance strategies
- This course describes about implementation and management of e-Government
- This course teaches how an effective strategic plan can be developed through a process.
- Conceptualization of ideas and development of service delivery models for improving the quality of service to citizen
- Teaches how to develop the vision, goals, policies and objectives for e-governance

Course contents:

UNIT – I: Basic of e-Governance   [9Hrs.]

E-Governance: Needs and Objectives of E-Governance, Types of e-Governance, Issues in E-Governance applications and the Digital Divide, Evolutionary stages of e-Governance its scope and content, E-Government versus E-Governance, Public Private Partnership for E-Government

History of e-Government in Nepal: Current Situation of e- Government Implementation in Nepal, E-Governance Product and Services in Nepal, State of e-Service delivery in Nepal, Reason behind failure of e-service Implementation in Nepal.

UNIT - II: E-Governance Model   [5hrs.]

Evolution in E-Governance and Maturity Models, Five Maturity Levels, Characteristics of Maturity Levels, Key areas: Towards Good Governance through E-Governance Models.

UNIT –III: E-Governance Architecture   [12hrs.]

Planning and Implementing e-Governance, ICT Infrastructure, Legal Framework of e-Governance, Enterprise Business Architecture Development, Public Management and Administration, Business Models for Implementation of e-Governance, e-Government Master Plan, e-Governance and Big Data for e-Governance

UNIT - IV: E-Governance Portals around the Globe   [14hrs.]

Present scenario of e-Government of Korea, India and Nepal, e-Government Development Index, e-Participation Index and e-Readiness Index of SAARC Countries. Study of e-Governance models of different countries, finding the gaps in each model, E-Governance Maturity Model, Case study of e-Governance outside Nepal.

UNIT - V: Security for e-Government   [5hrs.]

E-government security challenges, an approach to security for e-Governance, a model of security management, e-Government security architecture, security standard

Text / Reference books:

1. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Prentice-Hall of India Pvt. Ltd. 2011

2. Backus, Michael, e-Governance in Developing Countries, IICD Research Brief, No. 1, March 2001

3. E-government: from vision to implementation: a practical guide with case studies, Subhash C. Bhatnagar, SAGE , 2004

4. Implementation and Managing e-Government, Richard Heeks

5. Ganesh Gautam, Gajendra Sharma, Subarna Shakya and Mahesh Singh Kathayat, e-Government, 2020 (Forthcoming)

Course Title: Web Designing

Course Code: HCAC-302	**Credit hours: 3**
Year / Semester: II/V	**Full Marks: 60+20+20**
Nature of course: Theory + practical	**Pass Marks: 24+8+8**

Course Objectives:

- The objective of the course is to prepare skilled web designer as well as web programmer also.
- It includes the basic contents for web designing and programming like: HTML, CSS, JavaScript, PHP and MySQL technology.

Course Contents:

UNIT-I: HTML Basics [10 Hrs.]

Introduction, Designing web site, Advantages and Disadvantages of HTML, Flow of Web Information, Role of Web Browser and Web Server, Process of Web Publishing, HTML Elements, Attributes, Headings, Paragraphs, Formatting, Style, Comments, Links, Images, Table, Lists, Forms, frames.

UNIT-II: HTML5 [3 Hrs.]

Features of HTML5, Audio, Video, Figure, Section, Nav, Header, Footer

UNIT-III: Cascading Style Sheets (CSS) [8 Hrs.]

Introduction, Applications, Selectors, Using Styles (Inline, Internal and External), Comments, Colors, background, border, padding, margin, text, fonts, box, height/width, position, overflow, float properties., Introduction to responsive design.

UNIT-IV: JavaScript [8 Hrs.]

Introduction, Writing Comments, Variables, Operators, if Statements, Loops, Alert, Confirm, and Prompt Boxes, Functions, Event and Error Handling, Introduction to Built-in Classes, Form Validation, Cookies management

UNIT-V: PHP Basics [8 Hrs.]

History of web programming; how PHP fits into the web environment, PHP Installation and configuration, syntax, Variables, operators, flow control structures, More language basics; using GET and POST input, working with HTML forms; built-in and user-defined functions; variable scope; using the PHP manual, getting help, Input validation, string manipulation and regular expression functions; date and time functions.

Code re-use, require(), include(), and the include path; file system functions and file input and output; file uploads; error handling and logging; sending mail, HTTP headers and output control functions; HTTP cookies; maintaining state with HTTP sessions; writing simple web clients, Introducing MySQL; database design concepts; the Structured Query, Language (SQL); communicating with a MySQL backend via the PHP(CRUD Operation).

Laboratory Works:
1. Create Static web page including HTML Header, Paragraph, image, audio, hyperlink, list, table and forms.
2. Design the web page created in Lab no. 1 more attractive using CSS.
3. Design BCA admission form and validate every fields.
4. Write a JS code to manage cookies.
5. Write a program in PHP to implement String operations.
6. Write a program in PHP to read and write data from file.
7. Create a telephone directory using PHP and MySQL (show CRUD Operations).
8. Write a program to manage the session using PHP.

Reference books:
- John Dean, "Web Programming with HTML5, CSS, and JavaScript", Jones & Bartlett Publishers, 2019
- Frank M. Kromann, "Beginning PHP and MySQL from Novice to Professional", Fifth Edition, Apress
- Richard Blum, " PHP, MySQL & JavaScript all in one for Dummies", John Wiley & Sons, 2018.
- Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, "Programming PHP", O'Reilly Media
- Robin Nixon, "Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5"
- Complete HTML : BPB
- VIKRAM VASWANI, "PHP and MySQL", Tata McGraw-Hill

Course Title: Applied Economics
Course no: HCAEC-303   Credit hours: 3
Year / Semester: III/V   Full Marks: 60+40
Nature of course: Theory   Pass Marks: 4+16

.**Course objectives: -**

- 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.

Course contents:

UNIT – I: Introduction   **[5 Hrs.]**

Concept and types of micro economics and Macroeconomics: Distinction between micro economic and macroeconomics, Goals and instruments of macroeconomics, Interdependence of micro and macroeconomics, Use of micro and macroeconomic.

UNIT-II: Elasticity of demand and supply   **[6 Hrs.]**

Concept and types of Price, Income and Cross elasticity of demand, Measurement of Price, Income and Cross elasticity of demand. Total outlay method and point method, Arc method, Use of Price, Income and Cross elasticity, Concept elasticity of supply and its measurement (Numerical exercise using excel).

UNIT-III: Theory of consumer Behavior   **[6 Hrs.]**

Concept of cardinal and ordinal utility analysis, Cardinal utility analysis – assumptions, consumer equilibrium, criticism and derivation of demand curve., Ordinal utility analysis - concept, properties of indifference curve, marginal rate of indifference map substitution effect; Derivation of ICC, Budget line substitution effect, decomposition of price effect into income and substitution effect (Hicksian approach and Slusky Method), Derivation of individual demand curve from indifference curve, Derivation of Engel curve from Income consumption curve, demand for complementary and substitution goods.

UNIT – IV: Cost and Revenue curves.   **[6 Hrs.]**

Concept of cost : actual cost and opportunity cost, implicit cost and explicit cost, accounting and economic cost, Replacement cost, Separable cost, Derivation of short run and long curve (total, average and marginal) and shape of short run and long run average cost curve, Relationship between short run and long run AC and MC curves Concept of revenue : total revenue, average revenue and marginal revenue, revenue curve under perfect and imperfect competition, relationship between average and marginal revenue, Relationship between price elasticity and marginal revenue and total revenue, (Numerical exercise) .

UNIT – V: Market structure   **[10 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 characteristics of Monopoly pricing under Monopoly equilibrium of firm into 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 price under Monopolistic competition. Equilibrium of fir in short run and long run equilibrium of firm under product variation and selling expenses, Dumping, Oligopoly: - Meaning and characteristics of oligopoly. Pricing under cartel (aiming at Joint Profit maximization) (Numerical Exercise using Excel).

UNIT – VI: National Income Accounting   **[6 Hrs.]**

Circular flow of Income and expenditure in two sector, three sector and four sector economy, Meaning of National Income, Different of National Income GPA, NDP, GNP, NNP National Income at factor cost (NT) Personal Income (PI), Disposable Personal Income (DPI), Per Capital Income (PCI), Real and nominal GDP, GDP deflator, Computation of National Income , Product Income and Expenditure method, Difficulties of measurement of National Income, Importance of National Income accounting.

UNIT – VII: Money, Banking and International Trade   **[8 Hrs.]**

Concept and function of money – value of money – money supply – components of money supply (M_1, M_2, etc), Difficulties of barber system, Quantity theory of money. (Fisher's Equation)

Inflation: - types, causes and effects of Inflation, Deflation – causes and effects.

Banking: - Role of Banking system in Nepal. Functions of central bank, commercial bank and development bank with reference to Nepal.

International Trade: - Distinct between International Trade, balance of Trade and balance of payment. Free Trade and protectionism. Problems Nepalese Foreign Trade.

References books:

1. Ackley, Gardener. (1978). Macroeconomics: Theory and Policy. New York: Mc Milan Publishing Co.
2. Caves, Frankel, Jones, World Trades and Payments (9th Ed.) Pearson Education
3. Dominick Salvatore, International Economics:(8th Ed.). Wiley India.
4. Dwibedi, D.N. (2001). Macroeconomics Theory and Policy. Tata McGraw-Hill publishing Company Limited, New Delhi
5. G, Mankiw,(2007), Economics: Principles and Applications, South Western of Cengate Learing. Gupta, S.B. Monetary Economics, S. Chand & Co.; New delhi

Course Title: Probability & Statistics

Course code: HCAST-304	**Credit Hours: 3**
Nature of Course: Theory + Lab	**Full Marks: 60+20+20**
Year/Semester: III/V	**Pass Marks: 24+8+8**

Course Objectives:

- The main objective of the course is to provide fundamental concept of Statistics, Probability, Sample Survey and their applications in the area of Social Science and Computer Application.

Course Contents:

UNIT – I: Introduction   **[3 Hrs.]**

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

UNIT - II: Descriptive Statistics   **[6 Hrs.]**

Introduction, Criteria for good measure of Central Tendency, Measure of Central Tendency: Arithmetic Mean, Median, Partition Values, Mode, Numerical Problems.

Measure of Dispersion: Concept, Absolute and Relative Measures, Methods: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation, Numerical Problems.

UNIT - III: Correlation and Regression Analysis   **[6 Hrs.]**

Correlation: Introduction, Definition, Types of correlation, Methods of studying correlation: Scatter diagram, Karl Pearson's coefficient of correlation, Numerical Problems.

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

UNIT - IV: Probability   **[8 Hrs.]**

Introduction and Definition of Probability, Two basic Laws of Probability, Conditional Probability, Probability Distributions: Binomial, Poisson and Normal distributions, Numerical Problems(simple).

UNIT -V: Sample Survey   **[6 Hrs.]**

Meaning of Population and Sample; Needs of Sampling; Census and Sample survey; Concept of Sampling; Questionnaire Design; Sample Selection and Determination of sample size; sampling and Non sampling Errors and Concept of Central Limit Theorem.

UNIT - VI: 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, PPS sampling, Estimation of Population Total and its Variance, Sampling Distributions(t, x^2, z) and related problems.

UNIT – VII: Design of Experiment   **[6 Hrs.]**

Concept of 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:

The laboratory work includes implementing concepts of statistics using statistical software tool SPSS. SPSS software should be used for data analysis.

S.N.	Practical Problems	No. of Practical problems
2	Descriptive Statistics	3
3	Correlation and Regression Analysis	3
4	Probability	2
6	Sample Survey Methods	1
7	Design of Experiment	1
Total no. of Practical problems		**10**

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.
3. Dr. A.K. Chaudhary, "Business Statistics", Bhundipuran Prakashan, Ktm, Nepal.

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. Upadhaya, H.P., Paudel, K.C & et al, "Elements of Business Mathematics", Pinnacle Publication.
4. Montgomery Douglas C., "Design and Analysis of Experiments", 5th edition, John Wiley & Sons Inc., 2001.
5. SC Gupta & VK Kapoor, "Fundamentals of Statistics", Himalaya Publishing House, New Delhi, India.

Course Title: .Net Technology
Course no: HCAC-305   Credit hours: 3
Year / Semester: III/V   Full Marks: 60+20+20
Nature of course: Theory + Practical   Marks: 24+8+8

Course Objectives:

- This course is designed to provide the skills and knowledge on .Net Frameworks along with C# and ASP.Net.
- It includes C# basics, OOP with C#, Window Applications, ADO.NET and ASP.NET to achieve the required outcomes from the students of the domain.

Course Contents:

UNIT- I: .NET Framework   [4 Hrs.]

.Net Framework: basic concepts of .net framework: MSIL, JIT, CLR, CLS, Execution, Assemblies, and Application Domain. Features of C#, Intermediate language, Meta Data, .NET namespaces.

Building C# Applications: Role of the command line complier (csc.exe), Building a C# application using csc.exe, the command line debugger (cordbg.exe), using the visual studio .NET IDE & its debugging

UNIT-II: Introduction to C#   [8 Hrs.]

C# Console programming: Structure of C# program: name space, types, value type, simple type, reference type, boxing and unboxing, and their conversions. Variables & parameters, implicit conversion, explicit conversion and user-defined conversion.

Expressions: Expressions, types of expressions, C# operators: arithmetic operators, shift operators, logical operators, conditional operators, conversion operators, checked& unchecked operators. Control statements: sequence, Conditional statements, loops, jumping statements. Arrays & Collections: Introduction to arrays, Declarations and its types. Introduction to collection, Array list, jagged array, stack implementation.

UNIT-III: Object oriented programming: [10 Hrs.]

Class & Methods: Class, declarations, class modifiers, constructors & destructors, new modifier. Methods, method parameters, abstract class, sealed class, access modifiers, method overloading.

Inheritance: introduction, types, base class inheritance, derived class inheritance. Virtual methods, method overriding.

Interface: Interface, declaration modifiers, methods, properties, events.

Exception Handling: Definition, Exception handling techniques (statements), types, creating our own exception class. Multi-Threading

UNIT-IV: Windows Applications [8 Hrs.]

Windows Forms-Common Controls, Control Properties and Layout, Labels, TextBoxes and Buttons, GroupBoxes and Panels, CheckBoxes and RadioButtons, ToolTips, Mouse-Event Handling, Keyboard-Event Handling.Menus, Month Calendar Control, LinkLabel Control, ListBox Control, ComboBox Control, TreeView Control, ListView Control, TabControl and Multiple Document Interface (MDI)

Windows and Delegates: Introduction, types, multi-cast delegates.

UNIT-V: ADO.net: [8 Hrs.]

Components of ADO.net, Understanding ADO.NET: Describing the Architecture of ADO.NET, Connection Strings: Syntax for Connection Strings. Working with Connection Object: Creating a Connection to a database.

Database: SQL Server Database, OLEDB Database, Creating a Command Object. Inserting, Updating and Deleting Records. Working with Data Adapters: Creating DataSet from DataAdapter.

UNIT-VI: ASP.NET [7 Hrs.]

ASP.NET Overview of ASP.NET framework, Stages in Web Forms Processing, Introduction to Server Controls, HTML Controls, Validation Controls, User control, Data Binding Controls, Configuration, Personalization, Session State, Adding controls to a web form, Buttons, Text Box , Labels, Checkbox, Radio Buttons, List Box, etc.

Lab works:

1. Write a Program in C# to demonstrate the usage of classes & objects.
2. Write a program in C# to demonstrate the usage of decision making, looping& branching.
3. Write programs to demonstrate the concepts of Array, Multidimensional Array and Jagged Array.
4. Write programs in C# to demonstrate boxing and Unboxing.
5. Write programs to demonstrate Single Level Inheritance, Multilevel Inheritance.
6. Write a program to demonstrate interface in c#.
7. Write a programs in C# to demonstrate Operator overloading, virtual and override keywords, Abstract class.
8. Write a program in C# t demonstrate CONSOLE I/O OPERATION(Numerical formatting, Console IO of both number & strings)
9. Using Try, Catch and Finally blocks write a program in C# to demonstrate Exception Handling.
10. Write a program in C# demonstrate of Simple delegates without events.

Text Book:

1. Joseph Albahari & Eric Johansen, C# 8.0 in a Nutshell: The Definitive Reference, O'REILLY, 2020.
2. Ian Griffiths, "Programming C# 8.0 Build Cloud, Web, and Desktop Applications", O'REILLY, 2020.
3. Dino Esposito, "Programming ASP.NET Core", Pearson Education, 2018.

Reference Books:

1. Joon Skeet, "C# in depth", Manning, 4th Edition.
2. Adam Freeman, "Pro ASP.NET Core 3: Develop Cloud-Ready Web Applications Using MVC, Blazor, and Razor Pages", Apress, 2020.
3. E.Balaguruswamy: Programming in C#, 2nd Edition, Tata McGraw Hill, 2008.
4. 5. Herbert Schildt: C# The Complete Reference, Tata McGraw Hill

Course Title: MIS and e-Commerce

Course no: HCAC-351	**Credit hours: 3**
Year / Semester: III/VI	**Full Marks: 60+20+20**
Nature of course: Theory + Practical	**Marks: 24+8+8**

Course objectives:

To explain different types of Information Systems needed to meet information needs facilitating decision making at strategic, tactical and operational levels of management.

- Explain why Information Systems and Information Technology are critical resources that can have strategic impact on organization.
- Explain how Information Systems help organizations enhance business processes and the application of Electronics Commerce streamline existing business processes.
- Describe how Information Systems and application of Electronics Commerce provide competitive edge to organizations.

Course Contents:

UNIT-I: Introduction to Information Systems   [5 Hrs.]

Information systems; Information systems vs. information technology; Introduction to Management Information Systems, Impact of MIS, Computer literacy and information literacy; Information systems and organizational structures; Ethics and information system, Managers and activities in Information systems

UNIT-II: Information System for Managerial Decision   [6 Hrs.]

Structure of Management Information System, Transaction processing system; Decision support system: Components of DSS: Function of DSS: Application of DSS; Office automation system; Executive information system

UNIT-III: Business Information Systems   [6 Hrs.]

Functional Information Systems, Marketing Information Systems, Manufacturing Information Systems, Quality Information Systems, Human Resource Information Systems, Enterprise Resource Planning, Customer Relationship Management

UNIT-IV: Electronic Commerce Basics   [5 hrs.]

Meaning of Ecommerce, Emergence of Internet and commercial use of Internet, Advantage and disadvantages of Ecommerce, Electronic Data Interchange (EDI): Introduction to EDI, Benefits

of EDI, EDI Technology, EDI standards, EDI Communication, EDI Implementation, Mobile commerce and ecommerce portals, E-business, Supply Chain Management

UNIT-V: Business Model of Ecommerce   [5hrs.]

E-business model based on relationship of transaction, Parties: Business-to-Business, Business-to Consumer, Consumer-to-Consumer, Business-to-Government, Business processes examples

UNIT-VI: E-PAYMENT, MARKETING AND FINANCE   [10 Hrs.]

Transactions through Internet, Requirements of e-payment systems, Functioning of debit and credit cards, Impact of e-commerce on market, Traditional Marketing, Online Marketing, E-advertisement, E-banking, Traditional v/s E-banking.

UNIT -VII: SECURITY OF E-COMMERCE   [8 Hrs.]

Firewalls and network security, Types of firewalls, Transaction security, Types of online transactions, Requirements of transaction security, Technical solutions for privacy protection

Encryption and transaction security, Secret Key encryption, Public Key encryption, Implementation and management issues

Text Books:
1. Uma G. Gupta,"Management Information Systems, A Managerial Perspective", Tenth Edition, West Publishing Company.
2. Kalkota, Ravi: Whinston, Andrew B., "Frontier of Electronic Commerce", Pearson Education

Reference Books:

1. Kenneth C. Loudon/ Jane P. Laudon," Management Information Systems, Managing the Digital Firm", Twelfth Edition, Pearson.
2. Joseph P.T., " Ecommerce: A Managerial Perspective", Prentice Hall of India

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Course Title: Cyber Law and Computer Ethics
Course no: HCAC-352   **Credit hours: 3**
Year / Semester: III/VI   **Full Marks: 60+40**
Nature of course: Theory   **Pass Marks: 24+16**

Course Objectives:

- To identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
- To locate and apply case law and common law to current legal dilemmas in the technology field.

Course contents:

UNIT-I: Cybercrime Fundamentals   **[4 Hrs.]**
Cyber Security, Cybercrime, Forgery, Hacking, Virus, Software Piracy, Criminals Plan: Active Attack, Passive attack, Cyber Stalking, Public Key Certificate, IT Act and Legal Aspect.

UNIT-II: Cyber Law   **[8 Hrs.]**
UNCITRAL Model Law, Information Technology Act, Computer Network Intrusion Jurisdiction to Prescribe/Legislative Jurisdiction; Jurisdiction to Adjudicate to Enforce; Cyber Jurisdiction in Civil, Criminal & International Cases.

UNT-III: Cybercrime on Mobile & Wireless Devices   **[8 Hrs.]**
Security Challenges posted by Mobile Devices, Cryptographic Security for Mobile Devices, Attacks on Cell Phones, Theft, Virus, Bluetooth Hacking.

UNIT -IV: Techniques in Cyber Crime   **[12 Hrs.]**
Proxy Servers, Pan Word Checking, Random Checking, Trojan Horse and Backdoor; DoS & DDoS Attacks; SQL Injection: Buffer Overflow, Common Attacks, Scripts Kiddies, Packaged Defense, Phishing Method, ID Theft: Online Identity Method.

UNIT-V: Philosophical Ethics   **[6 Hrs.]**
Conceptual Muddles, Moral and Legal issues, Philosophical Ethics, Descriptive and Normative claims, Ethical Relativism, Utilitarianism and Deontological Theories, Rawlsian Justice, Virtue Ethics.

UNIT-VI: Professional Ethics   **[4 Hrs.]**
Characteristics of Profession, Computing as a Profession, Professional Responsibilities, Professional Rights, Code of Ethics of IEEE and ACM, Whistleblowing: Types, Condition, Prevention,

UNIT-VII: Privacy [3 Hrs.]

Computer related Privacy Issues and Reframing it, Legislative Background, Individual and Social Efforts in securing Privacy, Better Privacy Protection.

Case Study:

Students shall be given suitable case study related to different units, wherever possible, in a team to discuss and let them present in front of the class.

TEXT BOOKS

1. Anirudh Rastogi. Cyber Law, LexisNexis.
2. Deborah G Johnson, "Computer Ethics", 4th Edition, Pearson Education Publication, 2008

REFERENCES BOOKS:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
4. Roshan Chitrakar and Deepanjal Shrestha, Social and Professional Issues in IT, PAI, 2005.
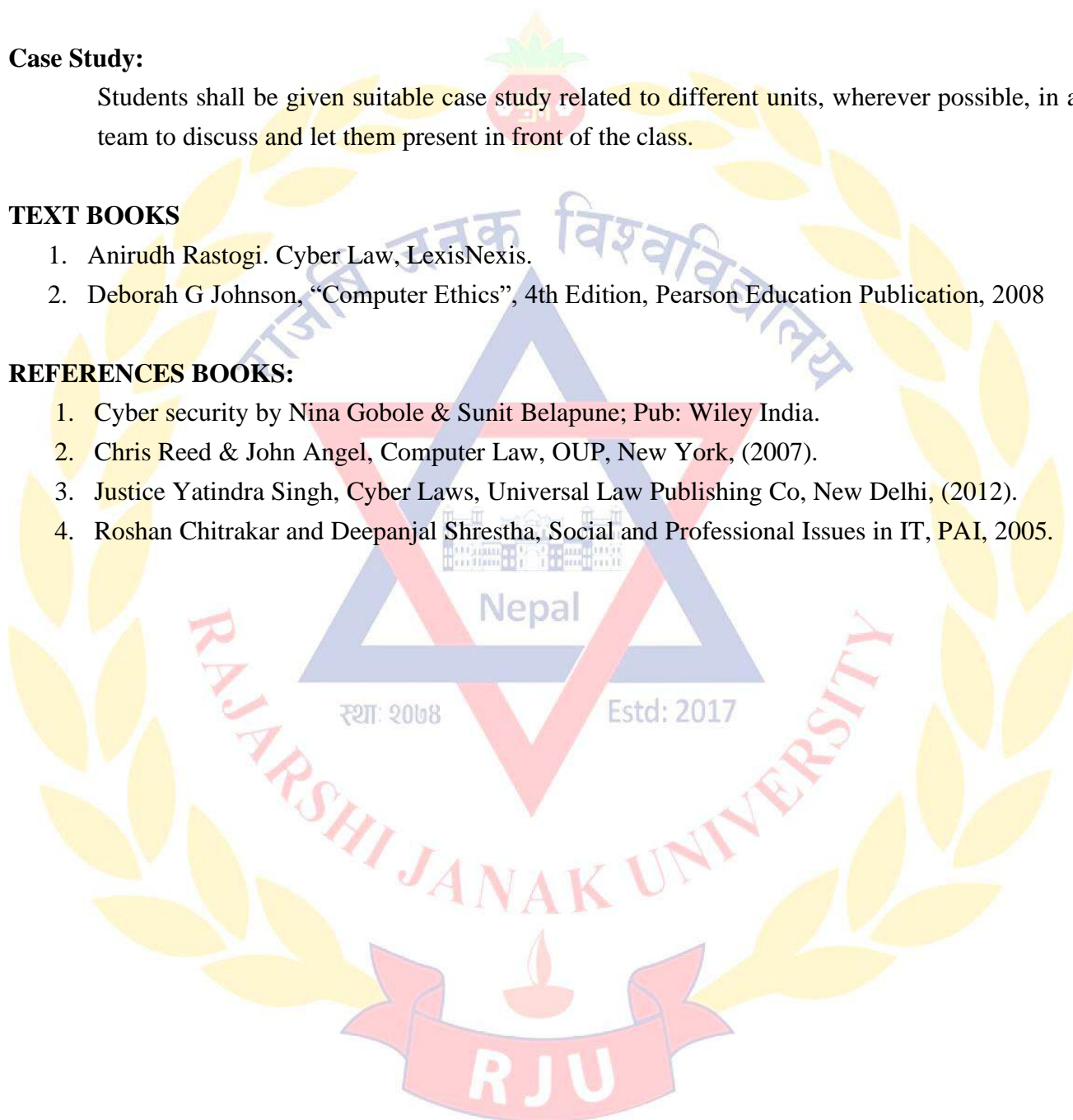
Course Title: Software Engineering
Course no: HCAC-353   Credit hours: 3
Year / Semester: III/VI   Full Marks: 60+20+20
Nature of course: Theory   Pass Marks: 24 +8+8

Course objectives:

- The aim of the programme in Software Engineering and Management is to provide students with theoretical knowledge and practical skills required in a knowledge-intensive and changing IT industry.
- The Software Engineering and Management programme is about methods and techniques for developing computer applications, asking the right questions to the customer, translating customer answers into design and managing projects, organizations and development teams.

Course contents:

UNIT-I: Introduction to software engineering and project management   [5 Hrs.]

Introduction to Software Engineering: Software, evolving role of software, Software characteristics, Three "R"-Reuse, Reengineering and Retooling, An Overview of IT Project Management: Define project, project management framework, The role of project Manager, Systems View of Project Management, Stakeholder management, Project phases and the project life cycle, Software quality attributes

UNIT-II: Software Process Models   [6 Hrs.]

Waterfall Model, Evolutionary Process Model: Prototype and Spiral Model, Incremental Process model: Iterative approach, RAD, JAD model, Concurrent Development Model, Agile Development: Extreme programming, Scrum.

UNIT-III: Software Requirements Engineering& Analysis   [7 Hrs.]

Computer-aided software engineering, Requirements Engineering: User and system requirements, Functional and non-functional requirements, Types & Metrics, A spiral view of the requirements engineering process. Software Requirements Specification (SRS): The software requirements Specification document, The structure of SRS, Ways of writing a SRS, structured & tabular SRS for an insulin pump case study, Requirements elicitation & Analysis: Process, Requirements validation, Requirements management.

UNIT-IV: Design Engineering   [6Hrs.]

Design Process & quality, Design Concepts, The design Model, Pattern-based Software Design. Architectural Design: Design Decisions, Views, Patterns, Application Architectures, Modeling Component level Design: component, designing class-based components, conducting

component-level design, User Interface Design: The golden rules, Interface Design steps & Analysis, Design Evaluation.

UNIT -V: Project Management: Process, Metrics, Estimations & Risks   [10 Hrs

Project Management Concepts: The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains, Software Measurement : size & function oriented metrics(FP & LOC), Metrics for Project and Software Quality, Feasibility study, Project Estimation :Observations on Estimation, Project Planning Process, Software Scope and feasibility, Resources: Human Resources, Reusable software, Environmental Resources. Software Project Estimation, Decomposition Techniques, Empirical Estimation Models: Structure, COCOMO II, Estimation of Object-oriented Projects, Specialized Estimation, Requirements validation and management

Project Scheduling: Basic Concepts, Defining a Task Set for the Software Project, Defining Task Network, Scheduling with time-line charts, Schedule tracking Tools:- Microsoft Project, Daily Activity Reporting & Tracking (DART)

UNIT-VI: Project Management: Risk Management, Configuration Management, Maintenance & Reengineering   [7 Hrs.]

Project Risk Management : Risk Analysis & Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Risks Monitoring and Management, The RMMM plan for case study project Software Configuration Management : The SCM repository, SCM process, Configuration management for WebApps, Maintenance & Reengineering: Software Maintenance, Software Supportability, Reengineering, Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering

UNIT-VII: Software Testing   [4 Hrs.]

Introduction to Software Testing, Principles of Testing, Testing Life Cycle, Phases of Testing, Types of Testing, Verification & Validation, Defect Management, Defect Life Cycle, Bug Reporting, GUI Testing, Test Management and Automation, Software Quality Assurance

Text books

1. Software Engineering, 5th and 7th edititon, by Roger S Pressman, McGraw Hill publication.
2. Managing Information Technology Project, 6edition, by Kathy Schwalbe, Cengage Learning publication.

Reference Books:

1. Information Technology Project Management by Jack T Marchewka Wiley India publication.
2. Software Engineering 3rd edition by KK Agrawal, Yogesh Singh, New Age International publication.
3. Software Engineering Project Management by Richard H. Thayer Wiley India Publication.

Course Title: Advance Java Programming
Course no: HCAC-354   **Credit hours: 3**
Semester: III/VI   **Full Marks: 60+20+20**
Nature of course: Theory + Lab   **Pass Marks: 24+8+8**

Course Objectives:

- Objective of this course is to make able to design console based, GUI based and web-based system. Students will learn to write, test, and debug advanced-level OOP program in Java.
- To relay the theoretical and practical knowledge of Advanced Java programming language.

Course Details:

UNIT-I: Java Applet   [3 hrs.]

Introduction to Applet, Applet Life Cycle, The Applet & Event Handling, Applet Fundamentals, Applet Architectures, An Applet skeleton, The HTML APPLET tag, Passing parameters to Applet.

UNIT- II: Swing Programming   [8 hrs.]

Introduction to Swing Package, Understand difference between Swing and AWT Programming, Components and Container, Swing and MVC Design Patterns, Layout Management: Border Layout, Grid Layout, Gridbag Layout, Group Layout, Custom layout Managers, Text Input: Text Fields, Password Fields, Text Areas, Scroll Pane, Label and Labeling Components, Choice Components: Check Boxes, Radio Buttons, Borders, Combo Boxes, Sliders, Menus: Menu Building, Icons in Menu Item, Check box and Radio Buttons in Menu Items, Pop-up Menus, Keyboard Mnemonics and Accelerators, Dialog Boxes, Components Organizers, Advance Swing Components

UNIT – III: Even Handling   [5 Hrs.]

Introduction: Standard Event Handling, Using Delegated Class, Using Action Commands, Listener Interfaces, Adapter Classes, Handling Events: Action Events, Key Events, Focus Events, Input Event Class, InputEvent Class ItemEvent Class, Window Event, Mouse Event, Item Events, Event Listener Interfaces, Using the Delegation Event Model

UNIT - IV: Database Connectivity   [5 Hrs.]

Introduction, Steps for connectivity Java and database, Types of JDBC Drivers, Writing JDBC applications using select; insert; delete; update, Types of Statement objects (Statement; Prepared Statement and Callable Statement), ResultSet; ResultsetMetaData; Inserting and updating records, Navigating a Result Set, Viewing and Updating a Result Set, Handling NULL values

UNIT – V: Java Beans   [4 Hrs.]

Introduction: Creating, Updating and Reading From JAR Files, Java Beans, Advantages of Java Beans, Class vs Beans, BDK and Bean Box, Java Bean: Creating a Java Bean, Creating a Bean Manifest File, Creating a Bean JAR File, Using a New Bean, Adding Controls to Beans, Giving a Bean Properties, Creating Bound Properties, Giving a Bean Methods, Giving a Bean an Icon

UNIT - VI: Servlet Programming   [6 Hrs.]

SERVLETS: Configuring directory structure for a web application, Servlet API Overview, Writing and running Simple Servlet, Servlet Life Cycle; GenericServlet and HttpServlet; ServletConfig & ServletContext; Writing servlet to Handle Get and Post Methods, Reading user request data; Concept of cookie; Reading and writing cookies

UNIT - VII: Java Server Pages   [5 Hrs.]

Introducing Java Server Pages, JSP Overview, Setting Up the JSP Environment, Generating Dynamic Content, Using Custom Tag Libraries and the JSP Standard Tag Library, Processing Input and Output.

UNIT - VIII: RMI and CORBA   [5 Hrs.]

Introduction of RMI, Architecture of RMI, Outline the Java Distributed Model, List the java.rmi packages, Explain the three-tiered layering of Java RMI, Implement RMI on a Remote and Local Host, Describe Remote Objets, Introduction to CORBA, Architecture of CORBA, Functioning of CORBA and CORBA services

UNIT -IX: Networking   [4 Hrs.]

Networking: Connecting to a Server: Using Telnet, Connecting to a Server with Java, Socket Timeouts, Internet Addresses, Implementing Servers: Server Sockets, Serving Multiple Clients, Half-Close, Interrupt Sockets, Getting Web Data: URLs and URIs, Using a URL Connection to Retrieve information, Posting Form Data, The HTTP Client, Sending E-Mail

Laboratory Work:

Lab work should content but not limited to all above content.

Reference Books:

1. Cay Horstmann and Grazy Cornell, Core Java Volume I-Fundamentals, Eighth Edition
2. Cay Horstmann and Grazy Cornell, Core Java Volume II-Advance Features, Eighth Edition
3. Steven Holzner, Java 2 Pagramming-AWT, Swing, XML and Java Beans Black Book, Dreamtech Press
4. Pallvi Jain and Shadab Siddiqui, J2EE Professional Projects, Premier Press

Course Title: Computer Graphics
Course no: HCAC-355   **Credit hours: 3**
Year / Semester: III/VI   **Full Marks: 60+20+20**
Nature of course: Theory +Practical   **Pass Marks: 24+8+8**

Course Objectives:

- The general objective of this course is to provide theoretical knowledge of two- and three-dimensional computer graphics and practical skills to implement different features and related algorithm of the same.

Course Contents:

UNIT-I: Introduction to Computer Graphics   **[5 Hrs.]**

Introduction and Applications of Computer Graphics, Display Technologies, Soft Copy Devices, Hard Copy Devices, Input Devices. Graphics Software, Software Standard, Need of Machine Independent Graphical Languages, Color Models.

UNIT-II: Scan Conversion   **[7 Hrs.]**

Points and Lines, Digital Differential Analyzer (DDA) and Bresenham's Line Drawing Algorithm, Midpoint Circle Algorithm, Scan Line Polygon Fill Algorithm, Inside-Outside Test, Scan Line Fill of Curved Boundary Areas, Boundary-Fill and Flood-Fill Algorithm; Line Attributes, Color and Gray Scale Levels.

UNIT-III: 2D Transformation and Viewing   **[8 Hrs.]**

Basic Transformation: Translation, Rotation and Scaling; Homogeneous Coordinates, Composite Transformations: Translation, Rotation and Scaling, Other Transformations: Reflection and Shear; Transformations Between Coordinate System, Viewing Pipeline, Window to Viewport Transformation, Point Clipping, Line Clipping: Cohen-Sutherland Line Clipping, Polygon Clipping: Sutherland-Hodgman Polygon Clipping.

UNIT-IV: 3D Object Representations   **[8 Hrs.]**

Polygon Surfaces: Polygon Tables, Plane Equations, Polygon Meshes; Curved Lines and Surfaces; Quadratic Surfaces: Sphere and Ellipsoid; Blobby Objects, Spline Representation, Cubic Spline Interpolation, Bezier Curves and Surfaces, B-Spline Curves and Surfaces.

UNIT V: 3D Transformations and Viewing   **[7 Hrs.]**

3D Transformation: Translation, Rotation, Scaling, Reflection and Shear; Composite Transformations, Viewing Pipeline, Viewing Coordinates: Transformation from World to Viewing Coordinates, Projections: Parallel and Perspective;

UNIT VI: Visible Surface Detection   **[4 Hrs.]**

Classification, Back Face Detection Method, Depth Buffer Method, A-Buffer Method, Scan Line Method, Depth Sorting Method

UNIT VII: Illumination and Surface Rendering   **[6 Hrs.]**

Introduction, Sources of Light, Illumination Models: Ambient Light, Diffuse Reflection, Specular Reflection and Phong Model; Intensity Attenuation, Color Considerations, Transparency, Shadows, Polygon Rendering Methods: Constant Intensity Shading, Gouraud Shading, Phong Shading and Fast Phong Shading

Laboratory Work

Laboratory work should consist of program development and testing in order to get the practical skills for the implementation of the topics discussed in the theory class using C or any appropriate programming language platform. Separate laboratory report should be submitted for each lab applicable unit on individual basis.

Text Book

1. D. Hearn and M. P. Baker, *Computer Graphics C Version,* Second Edition, Prentice Hall of India pvt.ltd.

Reference Books

1. J. D. Foley, S. K. Feiner and J. F. Hughes, *Computer Graphics: Principles and Practises,* 2nd Edition (In C), Pearson Education.
2. Z. Xiang and R. A. Plastock, *Schaum's Outline of Theory and Problem of Computer Graphics*, Mc Graw Hill, New Delhi,
3. B. B. Blundell, An Introduction to Computer Graphics and Creative 3-D Environment, Springer-Verlag London Ltd.

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Course Title	: Project II	
Course No	: HCAPJ-356	Credit Hours: 2
Year/Semester	: III/VI	Full Marks: 100
Nature of course	: Project	Pass Marks: 40

Course Objective:

- The main objective of this course is to develop both theoretical and practical skills needed to develop high-quality real-world software application using suitable software development technique

Course Description:
- This is the second project work of the BCA program that covers different theoretical and practical aspects needed to develop ready to use real world software applications that may be useful for general public or organizations. This course focuses in enabling students with the skills pertaining to the development of software applications including planning, analysis, design, and implementation activities. During this project, it is expected to develop high quality application with added features than in Project I.
- The project can be done in a group preferably with **FOUR / FIVE** members in each group. Students are highly recommended to work in group projects as group projects help them develop a host of skills that are increasingly important in the professional world. Positive group experiences, moreover, have been shown to contribute to student learning, retention and overall success. A supervisor is assigned to supervise each student during project in the college.

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Phases: The overall project work is divided into **THREE** phases:
3. Proposal Submission and Presentation
4. Mid-Term Presentation
5. Final Report Submission and Presentation

3. Proposal Submission and Presentation:
- The project team prepares proposal document in the prescribed format and submits to the college
- The panel coordinated by Head / Program Coordinator evaluates the proposal along with presentation from the student(s)
- If the proposal is accepted, a supervisor is assigned by the HOD / Program Coordinator depending upon the nature of the project

4. Mid-Term Presentation:
- The project team has to present their progress on the project in front of Head / Program Coordinator, Supervisor, and Internal Evaluator in the middle of the semester after completing approximately 50% of the project work.

5. Final Report Submission and Presentation:

- After submitting the final project report prepared in the prescribed format, the Project team has to present their final project in front of Head / Program Coordinator, Supervisor, Internal Evaluator and External Evaluator.

Proposal Contents:
- Title Page
- Introduction
  - Introduction
  - Problem Statement
  - Objective
  - Scope and limitation
- Methodology
  - Requirement Identification and Feasibility Study
  - Related Work / Literature Review
  - Analysis and Design Tools
  - Implementation tools (Front End, Back End)
- Expected Outcome
- Project Schedule
- References / Bibliography

Report Contents:
- Title Page
  - A standardized page for specifying the title and author of the work
- Certificate of Authorship
  - Declaration that the work reported is the original work
- Approval Sheet
  - Recommendation for approval from Head / Program Coordinator, Supervisor, External and Internal evaluators
- Acknowledgements
  - Thanking anyone who has helped you in any way
- Abstract
  - Giving a short overview of the work
- Table of Contents
  - Giving page numbers for all major section headings
- List of Figures
  - Giving page numbers for all the figures
- List of Tables
  - Giving page numbers for all the tables
- List of Abbreviations
  - List of abbreviations
- Introduction (Chapter I)
  - Introduction: Introduce the organization (if any) and the work
  - Problem Statement: Explain why you are doing this work and what is the problem being solved
  - Aims and Objectives: Clearly explain aims and objectives and scope of your work
  - System Development: Explain in brief about systems development, systems development methodology, and alternative approaches

- o Report Organization: Explain in brief about organization of your report
- Related Work / Literature Review (Chapter II)
  - o Explain the current state of the art in your area
  - o Explain the works other have people done (published or commercial) that is relevant to yours
- Analysis (Chapter III):
  - o Determining system requirements and studying feasibility
  - o Chose suitable approach (structured or object-oriented)
- Design (Chapter IV)
  - o Convert analysis document into design specifications
- Implementation (Chapter V)
  - o Coding: Design specifications are turned into working computer code using suitable programming language, database technology, and interfacing technology
  - o Testing: Tests are performed using various strategies; A master test plan is developed during the analysis phase; During the design phase, *unit*, *system* and *integration* test plans are developed; The actual testing is done during implementation
- Conclusion and Future Work (Chapter VI)
  - o Explain what conclusions you have come to as a result of doing this work and any future plan to extend the work
- References / Bibliography:
  - o Provide a list of papers, books and other publications that are explicitly referred to in the text
  - o Use IEEE citation style
- Appendices:
  - o Supplementary material should be included in appendices - these are optional, but they might contain:
  - o Code listings – A listing of the code you have written for the project. You should NOT include code listings for code you have not written!! If your project involves modifying code previously written by others, then you may include this other code as long as you indicate clearly in the code listing what parts have been written by you.
  - o Raw data – If your work involves data collection then this should usually be included in appendices. This should provide supporting evidence for claims made in the main part of the work (e.g., copies of a user evaluation questionnaire and some sample responses).
  - o Examples of test data
  - o Electronic material on a CD/DVD/Pen Drive inside the back cover. This might contain executable software, source code, graphics, slides used for your presentation, etc. Where the appendices are long (e.g. code listings) do not print them out, rather provide them on a CD/DVD/Pen Drive

Report Format:

- Page Number
  The pages containing certificate of approval to the page containing list of abbreviations should be numbered in roman starting from i. The pages starting from Chapter 1 onwards should be numbered in numeric starting from 1. Page numbers should be inserted at the bottom of the page and aligned centre.

- Paper Size and Margin
  The paper size should be A4 and the margins must be set as:
    o Top = 1 in (2.54 cm)
    o Bottom = 1 in (2.54 cm)
    o Left = 1.25 in (3.17 cm)
    o Right = 1 in (2.54 cm)
- Paragraph
  All paragraphs must be indented and justified (both left-justified and right-justified). All the paragraphs must be written using Times New Roman font with font size 12 and 1.5 paragraph spacing.
- Heading
  No more than 3 levels of headings should be used. Font size for the heading should be 16 for chapter title, 14 for section headings and 12 for subsection headings. All the headings should be bold faced.
- Figures and Tables
  Figure captions should be centred below the figures and table captions should be centred above the table.

Evaluation:

Head / Program Coordinator, Supervisor, Internal and External evaluators will evaluate the overall project work. External evaluator will be assigned only for the final defense.

Marks Allocation:
- Supervisor – 60
- Internal Evaluator – 10
- Head / Program Coordinator – 10
- External   20

Total – 100

Weight of each Phase:
- Proposal Submission and Presentation - 10%
    o Evaluated by Head / Program Coordinator (2 Marks), Supervisor (6 Marks), and Internal (2 Marks)
- Mid-Term Presentation - 20%
    o Evaluated by Head / Program Coordinator (3 Marks), Supervisor (14 Marks), and Internal evaluator (3 Marks)
- Final Report Submission and Presentation - 70%
    o Evaluated by Head / Program Coordinator (5 Marks), Supervisor (40 Marks), Internal evaluator (5 Marks), and External evaluator (20 Marks)

Text Books: None

Prerequisite: Depending upon types of project

Course Title: Programming in Python
Course no: HCAC-401   **Credit hours: 3**
Year / Semester: IV/VII   **Full Marks: 60+20+20**
 Nature of course: Theory + Practical   **Marks: 24+8+8**

Course Objectives:

To make able the students to use python as a programming language to develop the solutions based on computer system.

Course contents:

UNIT- I: Introduction and Overview   [7 Hrs.]

Introduction to Python Programming, Strengths and Weaknesses of Python Programming, Python programming environment setup, Integrated Development Environment(IDEs) for python, Structure of python program, Writing and executing simple program, Data Types, Variables, Comments, Operators, Simple Input-Output operations, Precedence of Operators, Type Conversions, Conditional Statements: if, if-else, if-else-if, nested if, Looping: For, While, Nested Loops, Terminating Loops, Skipping Specific Conditions.

UNIT-II: Functions, Modules and Strings: [7 Hrs.]

Functions: Defining a function, Calling a function, Types of functions, Parameters and Arguments, Anonymous functions, Scope and Lifetime of variables,

Modules: Commonly used modules, importing module, Creating & exploring modules, Math module, Random module, Time module

Strings: Creating and Storing Strings, String Operations, Basic String functions, String manipulation: Slicing, Joining, accessing characters by index number, formatting Strings Converting other types in Strings.

Unit III: Object Oriented Programming: [5 Hrs.]

Class and Objects, Inheritance, Encapsulation and Polymorphism

UNIT-IV: List, Dictionaries, Tuples and Sets: [5 Hrs.]

List: Definition, Creating List, List Methods, Manipulating List , Dictionaries: Definition, Creating Dictionary, Dictionary Methods, Tuples: Introduction to Tuples, Tuple Methods, Manipulating Tuples, Sets: Sets and Set Methods.

UNIT-V: Python File Input-Output, Exception Handling and Regular Expression [6 Hrs.]

Types of Files, Opening and Closing Files, File Methods to read and write data, Creating, Reading and Writing Files, Manipulating Directories.

Exception Handling: Exception handling in python, use of try, except, else, finally and raise
Regular Expressions: Concept of regular expression, various types of regular expressions, regular expression functions.

UNIT-VI: GUI Programming in Python (using Tkinter or Qt):   [8 Hrs.]
Defining GUI, Advantages of GUI, Introduction to GUI library, Layout management, Events and bindings, Font, Colors, drawing on Canvas (line, oval, rectangle, etc.)
Widgets such as: Frame, Label, Button, Checkbutton, Entry, Listbox, Message, Radiobutton, Spinbox etc.

UNIT VII: Database Connectivity   [4 Hrs.]
Installing mysql connector, accessing connector module using connect, curso, Execute& close functions, reading single & multiple results of query execution, executing different types of statements, executing transactions, Understanding exceptions in database connectivity.

UNIT VIII: Development framework in Python: [3 Hrs.]
Django: Introduction and features. Install, configure and implement Django frame work for web development.

Practical Work:
Develop a small-scale real-time project in python using a development framework.

Text Books:
1. Gowrishankar S., Veena A., Introduction to Python Programming, CRC (2019)
2. John Hunt, A Beginners Guide To Python 3 Programming, Springer (2019)
3. Jesper Wisborg Krogh, MySQL Connector_Python Revealed, Apress (2018)
4. William S. Vincent, Django for Professionals: Production Websites with Python & Django, 2019

Reference Books :
- E. Balaguruswamy, Introduction To Computing And Problem Solving Using Python, Mc Graw Hill India (2016)
- Chun, J Wesley, Core Python Programming, Second Edition, Pearson, 2007 Reprint 2010
- MySQL for Python: Database Access Made Easy- A. Lukaszewski
- Barry, Paul, Head First Python, 2nd Edition, O Rielly, 2010
- Lutz, Mark, Learning Python, 4th Edition, O Rielly, 2009
- Introduction to Computer Science using Python- Charles Dierbach
- Beginning Python: Using Python 2.6 and Python 3- James Payne

Course Title: Operational Research
Course no: HCAC-402   **Credit hours: 3**
Year / Semester: IV/VII   **Full Marks: 60+20+20**
Nature of course: Theory   **Pass Marks: 24+8+8**

Course Objectives:

- To define what is meant by operations research, and account for which phases are normally part of a study applying operations research.
- To describe the assumptions on which linear programming (LP) is built
- To formulate and solve a number of network models
- Model formulation and applications that are used in solving business decision problems
- To discuss the pros and cons of the different types of models and the associated solution methods in view of specific problems.

Course contents:

UNIT – I: Introduction to Operations Research [9 Hrs.]

Introduction to Operations Research, Operations Research definition and origin. Linear Programming Problems: Origin and development of operations research, Linear Programming Problem –formulation of Linear Programming problem, Graphical Solution, Linearity requirement, Theory of simplex method. Use of artificial variables and their solution.

UNIT – II: Transportation problem [9 Hrs.]

Transportation Problem: Mathematical formulation of transportation problem, Initial basic Feasible solution, North West corner rule, Matrix minima method, Vogel's approximation method, MODI method to find optimal solution, Moving Towards Optimality

UNIT – III: Assignment Problem [9 Hrs.]

Assignment Problem: Mathematical formulation of an Assignment problem, Assignment algorithm, Hungarian Method to solve Assignment Problem, Travelling Salesman Problem

UNIT – IV: Network Analysis   [9 Hrs.]

Network Analysis: Basic components of Network, Rules for drawing Network diagram Time calculation in Networks. Critical Path Method and PROJECT Evaluation and Review Techniques. Algorithm and flow chart for CPM and PERT.

UNIT - V: Theory of Games   [9 Hrs.]

Theory of Games: Two –person Zero –sum Games, Competitive situations, the maximin and Minimax principle, Saddle point and value of the Game. Game without saddle points, mixed strategies, solution for 2X2 games, Graphical method Dominance property.

Text books:

1. Taha, "Operations Research", 7 th edition, Pearson Education, 2007.

References Book:

1. Billey E. Gillett, "Introduction to Operations Research" , Himalaya Publishing House, Delhi, 1979.
2. Hamady A.Taha "Operations Research" , Collin Mac Millan, 1982.
3. Wayne L. Winston, Practical Management Science: spreadsheet modeling and applications.

१)   पाठ्यांश परिचय :

प्रस्तुत पाठ्यांश ... HCANP-405.............. कार्यक्रम अन्तर्गत नेपाली विषयमा व्यवहारिक प्रयोजनका लागि तयार पारिएको हो । यसमा अभिव्यक्ति कला र यसका प्रकार अनुच्छेद लेखन, बोधलेखन, व्यवहारिक लेखन, प्रशासनिक लेखन, प्रतिवेदन लेखन, भाषा सम्पादन, वर्णविन्यास तथा पाण्डुलिपि सम्पादनसँग सम्वद्ध पाठ्यसामग्री राखिएका छन् । यी सामग्रीबाट विद्यार्थीहरुमा लेखन तथा सम्पादनका विविध भाषिक, व्यवहारिक प्रयोजन गर्न सक्षम हुने अपेक्षा राखिएको छ ।

२)   साधारण उद्देश्य :

यस पाठ्यांशका साधारण उद्देश्यहरु यसप्रकार छन् :

क)   अभिव्यक्तिको परिचय सहित यसका प्रकार एवं विविध प्रकृतिका लेखन सिपको विकास गराउने,

ख)   अनुच्छेदको सैद्धान्तिक अवधारणाका साथै विविध स्वरुपको अनुच्छेद रचनाको अभ्यासमा सहभागी गराउने,

ग)   व्यवहारिक लेखन (विज्ञापन, सम्पादकलाई चिठी, शुभकामना, बधाई, श्रद्धाञ्जली / सम्वेदना), प्रतिवेदन लेखन, निबन्ध लेखन, व्यक्तिवृत्त लेखन सिपको विकास गराउने,

घ)   ज्ञान, विज्ञान, प्रविधिका विभिन्न क्षेत्रसँग सम्बन्धित लिखित अभिव्यक्तिबाट पठन बोधको क्षमताको विकास गराउनु ।

ङ)   प्रशासनिक लेखन (नियुक्ति पत्र, परिपत्र, कार्यालय-टिप्पणी), कानूनी लेखन   (राजिनामा, तमसुक, करारनामा, बोलपत्र-आव्हान जस्ता लेखन ढाँचा तयार गर्न सक्षम तुल्याउने,

च)   भाषा सम्पादनका सैद्धान्तिक स्वरुपको वर्ण विन्यासको आधारमा छपाई शुद्धि चिन्हका उपयोग गरी पाण्डुलिपि सम्पादन क्षमतामा अभिवृद्धिमा जोड दिन सक्षम बनाउने आदि ।

३)   विशिष्ट उद्देश्य तथा पाठ्य विषय :

एकाइगत विशिष्ट उद्देश्य	पाठ्य विषय

• अभिव्यक्तिको परिचय दिई यसका प्रकार चिनाउन, • लिखित अभिव्यक्ति र यसका प्रकार बताउन ।	एकाइ १ अभिव्यक्ति (१२) १.१ अभिव्यक्तिको परिचय १.२ अभिव्यक्तिका प्रकार (क) मौखिक (ख) लिखित १.३ लिखित अभिव्यक्तिका प्रकार (क) सामान्य लेखन (ख) व्यवहारिक लेखन (ग) व्यवसायिक लेखन (घ) प्रयोजनपरक लेखन (ङ) प्राज्ञिक/बौद्धिक लेखन (च) सिर्जनात्मक लेखन (छ) सम्पादनात्मक लेखन
• अनुच्छेद लेखनको परिचय दिई यसको संरचना बनाउन • विविध विषयमा आधारित अनुच्छेद लेखन गर्न	एकाइ २ अनुच्छेद लेखन (१२) २.१ अनुच्छेदको परिचय २.२ अनुच्छेद लेखनको संरचना २.३ अनुच्छेदका प्रकार (क) वस्तुपरक (ख) आत्मपरक (ग) तार्किक (घ) भावपरक (ङ) आख्यानात्मक
• व्यवहारिक लेखनको परिचय दिन, • व्यवहारिक लेखनका विभिन्न संचार तयार गर्न	एकाइ ३ व्यवहारिक लेखन (१२) ३.१ व्यावहारिक लेखनको परिचय ३.२ व्यवहारिक लेखनको ढाँचा • पत्रलेखन (कार्यालयीय)

	● माइन्युट लेखन (निर्णय पुस्तिका लेखन)
	● सूचना
	● विज्ञापन
	● सम्पादकलाई चिठी
	● शुभकामना
	● बधाई
	● श्रद्धाञ्जली/समवेदना
	● व्यक्तिवृत्त
	● प्रतिवेदन लेखन
	● निबन्ध लेखन
● प्रशासनिक लेखनको रिचय दिन ● प्रशासनिक क्षेत्रका विभिन्न प्रकारका लेखन गर्न	एकाइ ४ प्रशासनिक लेखन (१२) ४.१ प्रशासनिक लेखनको परिचय ४.२ प्रशासनिक लेखनको ढाँचा ● नियुक्ति पत्र ● परिपत्र ● कार्यालय टिप्पणी ● करारनामा ● मिलापत्र ● बोलपत्र आह्वान
● पठनबोधको परिचय बुभ्mन, ● ज्ञान, विज्ञान, प्रविधि आदि विविध क्षेत्रका पठन बोध ग्रहण गर्न	एकाइ ५ (पाँच) पठनबोध (१२) ५.१ पठन बोधको परिचय ५.२ ज्ञान, विज्ञान, प्रविधि आदि विविध क्षेत्रका विशिष्ट पठन बोध र अभिव्यक्ति गर्न,

	५.२.१ उक्त पाठ्यसामग्रीहरुमा प्रयुक्त शब्दहरुको अर्थ र प्रयोग गर्ने अभ्यास, ५.२.२ उक्त सामग्रीमा प्रयुक्त विशिष्ट शैलीको पहिचान तथा प्रश्नोत्तर गर्ने अभ्यास
• पाण्डुलिपि सम्पादनको परिचय दिन • छपाई शुद्धि र चिन्ह प्रयोग गरी सम्पादन गर्न • छपाई शुद्धि र चिन्ह प्रयोगद्वारा पाण्डुलिपि सम्पादन गर्न • पाण्डुलिपिको अन्तिम रुप (प्रेस रेडी कपी) तयार गर्न	एकाइ ६ पाण्डुलिपिको सम्पादन (१२) ६.१ पाण्डुलिपि सम्पादनको परिचय ६.२ छपाई शुद्धि र चिन्ह प्रयोग ६.३ छपाई शुद्धि र चिन्ह प्रयोग ढाँचा ६.४ पाण्डुलिपिको अन्तिम तयारी

टिप्पणी (कोष्ठ भित्रका अङ्कले प्रत्येक एकाइलाई दिइएको अनुमानित घण्टी जनाउँछ ।

४) **शिक्षण प्रविधि**

प्रत्येक एकाइमा आवश्यकता अनुसार साधारण र विशिष्ट विधिको उपभोगमा ल्याइनेछ ।

४.१ **साधारण शिक्षण प्रविधि**

एकाइको आवश्यकता अनुरुप पाठ्यपुस्तक, सन्दर्भ पुस्तक, पाठपत्र, तालिका, आरेखहरुको उपयोग गरी व्याख्यान, छलफल, प्रश्नोत्तर विधि र प्रस्तुतीकरणको उपयोग गरिनेछ ।

४.२ **विशिष्ट शिक्षण प्रविधि**

एकाइ	कार्यकलाप
१	• अभिव्यक्तिका विभिन्न प्रकारहरुको शिक्षकले सैद्धान्तिक जानकारी गराउने र यससँग सम्वद्ध लिखित अभिव्यक्तिका व्यक्तिगत विभिन्न ढाँचाका रुपमा तयार गर्न लगाउने ।
२	• अनुच्छेदको सैद्धान्तिक परिचय दिई विभिन्न विषय क्षेत्रसँग सम्वन्धित अनुच्छेदको नमूना ढाँचा तयार गरी कक्षामा प्रस्तुत गर्ने ।
३	• व्यवहारिक लेखन र यसका महत्व बारे शिक्षकले कक्षामा जानकारी गराउने ।

	• व्यवहारिक लेखनसँग सम्वन्धित विभिन्न प्रकारका कार्यालयीय र प्रशासनिक चिठी लेख्न लगाई कक्षामा प्रस्तुत गर्न लगाउने । • विभिन्न ढाँचामा माइन्युट लेखन, सूचना, विज्ञापन, शुभकामना बधाई, श्रद्धाञ्जली, प्रतिवेदन लेखन, व्यक्तिगत निबन्ध लेखन तयारी गरी कक्षामा प्रस्तुत गर्न लगाउने र शिक्षकले आवश्यक पृष्ठपोषण दिने ।
४	• प्रशासनिक लेखनसँग सम्वन्धित निर्धारित विभिन्न ढाँचाका नमूना तयार पारी विद्यार्थीलाई आवश्यक जानकारी गराउने । • विद्यार्थीलाई प्रशासनिक लेखनका विभिन्न ढाँचा लेख्न लगाई कक्षामा प्रस्तुत गर्न लगाउने र आवश्यक पृष्ठपोषण प्रदान गर्ने ।
५	• पठन बोध सम्वन्धी विविध ज्ञान, विज्ञान, प्रविधि, साहित्य क्षेत्रका पठन बोध सम्वन्धी जानकारी गराउने । • विविध क्षेत्रका अनुच्छेद (रचना दिई) पठन बोध सम्वन्धी प्रश्नको उत्तर लेख्न लगाउने र शिक्षकले आवश्यक पृष्ठपोषण गर्ने ।
६	• पाण्डुलिपिको सम्पादन र यसका प्रविधि पक्षको सैद्धान्तिक जानकारी दिई कुनै पनि विषयमा नमूना पाण्डुलिपि तयार गर्न लगाउने । • पाण्डुलिपिमा वर्णविन्यासको आधारमा छपाई शुद्धिका चिन्हको प्रयोग गर्न लगाउने ।

५) मूल्याङ्कन

यस पाठ्यांशको अन्तिम मूल्याङ्कन रा.वि.वि. परीक्षा प्रणाली अनुसार सत्र परीक्षाद्वारा गरिनेछ । अध्यापन अवधिभित्र कक्षा कार्यकलापका रुपमा पाठ्यवस्तुको प्रकृति अनुसार समूहकार्य, मौखिक तथा लिखित प्रस्तुतिद्वारा विद्यार्थीहरुको मूल्याङ्न गर्न सकिनेछ ।

सत्र परीक्षामा सोधिने प्रश्नको प्रकृति, प्रश्नढाँचा र त्यसको अङ्कभार निम्नानुसार हुनेछ ।

क्र.सं.	परीक्षाको किसिम	प्रश्नको किसिम	अङ्क

१	सैद्धान्तिक	वस्तुगत (१०x१)	१०
		विषयगत प्रश्न	
		संक्षिप्त प्रश्न (६x५)	३०
		लामो प्रश्न (२x१०)	२०
२	प्रयोगात्मक	आन्तरिक १५	४०
		वाह्य २५	
		जम्मा	१००

सन्दर्भग्रन्थसूची

१) गौतम, देवीप्रसाद र आचार्य, व्रतराज (२०६१) विशेष नेपाली, काठमाडौं : विद्यार्थी पुस्तक भण्डार ।

२) गौतम देवीप्रसाद, भण्डारी, पारसमणि र ओझा रामनाथ (२०७२) स्नातक नेपाली काठमाडौं : विद्यार्थी पुस्तक भण्डार

३) न्यौपाने, नेत्रप्रसाद र तिम्सिना, शिवप्रसाद (२०७५) व्यवहारिक लेखन तथा सम्पादन, काठमाडौं : पिनाकल पब्लिकेशन प्रा.लि. ।

४) भण्डारी, पारसमणि (२०७५) व्यवहारिक लेखन तथा सम्पादन काठमाडौं : विद्यार्थी पुस्तक भण्डार ।

५) सुवेदी लालनाथ (२०६९) नेपाली बोध र रचनाशिल्प, काठमाडौं : विद्यार्थी पुस्तक भण्डार ।

६) अन्य सन्दर्भग्रन्थहरु

Course Title	: Internship	
Course No	: HCAIN-404	Credit Hours : 3
Year/Semester	: IV/VII	Full Marks: 100
Nature of course	: Internship	Pass Marks: 40

Course Objective:

- The main objective of this course is to expose students to a particular job and a profession in the IT industry.
- It gives students the opportunity to re-examine their career objectives and explore the variety of opportunities in the field of Information and Communication Technology. An internship provides a variety of benefits for students who want to broaden their chances for landing a job and jump-starting their careers.
- Internships give students a taste of what a profession is like, help them meet people who can provide guidance, feedback, and support.

Course Description:

This course is about learning professional experience that offers meaningful, practical work related to computer application study or career interest. This course gives a student the opportunity for career exploration and development, and to learn new skills in the IT industry. It offers the employer the opportunity to bring new ideas and energy into the workplace, develop talent and potentially build a pipeline for future full-time employees.

The internship period will be minimum of **TEN w**eeks to ensure enough professional experience and skill to a particular job or profession of industry.

Many companies offer internship for computer application students. Students may choose to do their internship in different sectors that develop or use information technology frequently like software development companies, telecommunications companies, network and internet service-related companies, government sectors, Banks, Hospitals etc. Internship can be done in groups, but each student must prepare a separate report on the basis of his/her part in the group work. Mentors are assigned to advise each student during internship in the company. A supervisor is also assigned to supervise each student during internship in the college.

Role of Mentor:

Mentors are assigned to advise each student during internship in the company. Mentors are expected to share their experience, insight, and enthusiasm with the student throughout the internship. They should continually monitor the progress of the student, assessing written and oral communications and guiding the development of the student's technical and managerial skills, effectiveness and presentation of self. Advisors are expected to submit a post-internship evaluation of the student's accomplishments and abilities and of the internship program in general.

Role of Supervisor:

A supervisor is assigned to each student to supervise works and progress during the internship in the college. Supervisors help students by giving ideas to solve problems to the activities assigned to the students in the company. They also monitor the progress of the internship and give ideas to prepare proposal and final report of the internship.

Role of Student:

In order for the internship to be beneficial, student should begin with a definition of his/her objectives and specific interests to ensure that appropriate activities and projects are assigned. The student will be responsible for the timely completion and of all activities and projects assigned and with professional quality. Student should inform the status of all assignments to the advisor and perform all the duties as assigned. The student is expected to speak frequently with the advisor on the progress and interest in other projects, as well as to discuss observations and questions about meetings, projects and other activities with which he/she is involved.

Phases: The overall internship work is divided into two phases:
6. Mid-Term Presentation
7. Final Report Submission and Presentation

6. Mid-Term Presentation:
- Students have to present their progress in the middle of the semester after completing approximately 50% of the internship work.

7. Final Report Submission and Presentation:
- Students prepare final report in the prescribed format and present their work for final evaluation.

Report Contents:
- Title Page
  - A standardized page for specifying the title and author of the work
- Certificate of Authorship
  - Declaration that the work reported is the original work
- Approval Sheet
  - Recommendation for approval from Head / Program Coordinator, Supervisor, External and Internal evaluators
- Acknowledgements
  - Thanking anyone who has helped you in any way
- Abstract
  - Giving a short overview of the work
- Table of Contents
  - Giving page numbers for all major section headings
- List of Figures
  - Giving page numbers for all the figures
- List of Tables
  - Giving page numbers for all the tables
- List of Abbreviations
  - List of abbreviations
- Introduction (Chapter I)
  - Introduction: Introduce the organization and the work
  - Problem Statement: Explain why you are doing this work and what is the problem being solved
  - Aims and Objectives: Clearly explain aims and objectives and scope of your work
  - Report Organization: Explain in brief about organization of your report

- Related Work / Literature Review (Chapter II)
  - Explain the current state of the art in your area
  - Explain the works other have people done (published or commercial) that is relevant to yours
- Internship Activities (Chapter III):
  - Explain different activities done during the internship period
- Conclusion (Chapter IV)
  - Explain what conclusions you have come to as a result of doing the internship work
- References / Bibliography:
  - Provide a list of papers, books and other publications that are explicitly referred to in the text
  - Use IEEE citation style
- Appendices:
  - Supplementary material should be included in appendices - these are optional, but they might contain:
  - Code listings – A listing of the code you have written for the project assigned during internship. You should NOT include code listings for code you have not written!! If your project involves modifying code previously written by others, then you may include this other code as long as you indicate clearly in the code listing what parts have been written by you.
  - Raw data – If your work involves data collection then this should usually be included in appendices. This should provide supporting evidence for claims made in the main part of the work (e.g., copies of a user evaluation questionnaire and some sample responses).
  - Examples of test data
  - Electronic material on a CD/DVD/Pen Drive inside the back cover. This might contain executable software, source code, graphics, slides used for your presentation, etc. Where the appendices are long (e.g. code listings) do not print them out, rather provide them on a CD/DVD/Pen Drive

Report Format:
- Page Number
  The pages containing certificate of approval to the page containing list of abbreviations should be numbered in roman starting from i. The pages starting from Chapter 1 onwards should be numbered in numeric starting from 1. Page numbers should be inserted at the bottom of the page and aligned centre.
- Paper Size and Margin
  The paper size should be A4 and the margins must be set as:
  - Top = 1 in (2.54 cm)
  - Bottom = 1 in (2.54 cm)
  - Left = 1.25 in (3.17 cm)
  - Right = 1 in (2.54 cm)
- Paragraph
  All paragraphs must be indented and justified (both left-justified and right-justified). All the paragraphs must be written using Times New Roman font with font size 12 and 1.5 paragraph spacing.
- Heading

No more than 3 levels of headings should be used. Font size for the heading should be 16 for chapter title, 14 for section headings and 12 for subsection headings. All the headings should be bold faced.

- Figures and Tables
  Figure captions should be centred below the figures and table captions should be centred above the table.

Evaluation:

Head / Program Coordinator, Supervisor, Mentor, and External evaluator will evaluate the overall internship work. External evaluator will be assigned only for the final defense.

Marks Allocation:
- Supervisor – 20
- Mentor – 50
- Head / Program Coordinator – 10
- External – 20

Total – 100

Weight of each Phase:
- Mid-Term Presentation - 15%
  o Evaluated by Head / Program Coordinator (5 Marks) and Supervisor (10 Marks)
- Final Report Submission and Presentation - 85%
  o Evaluated by Head / Program Coordinator (5 Marks), Supervisor (10 Marks), Mentor (50 Marks), and External evaluator (20 Marks)

Text Books: None
Prerequisite: Depending upon types of organization and internship activities
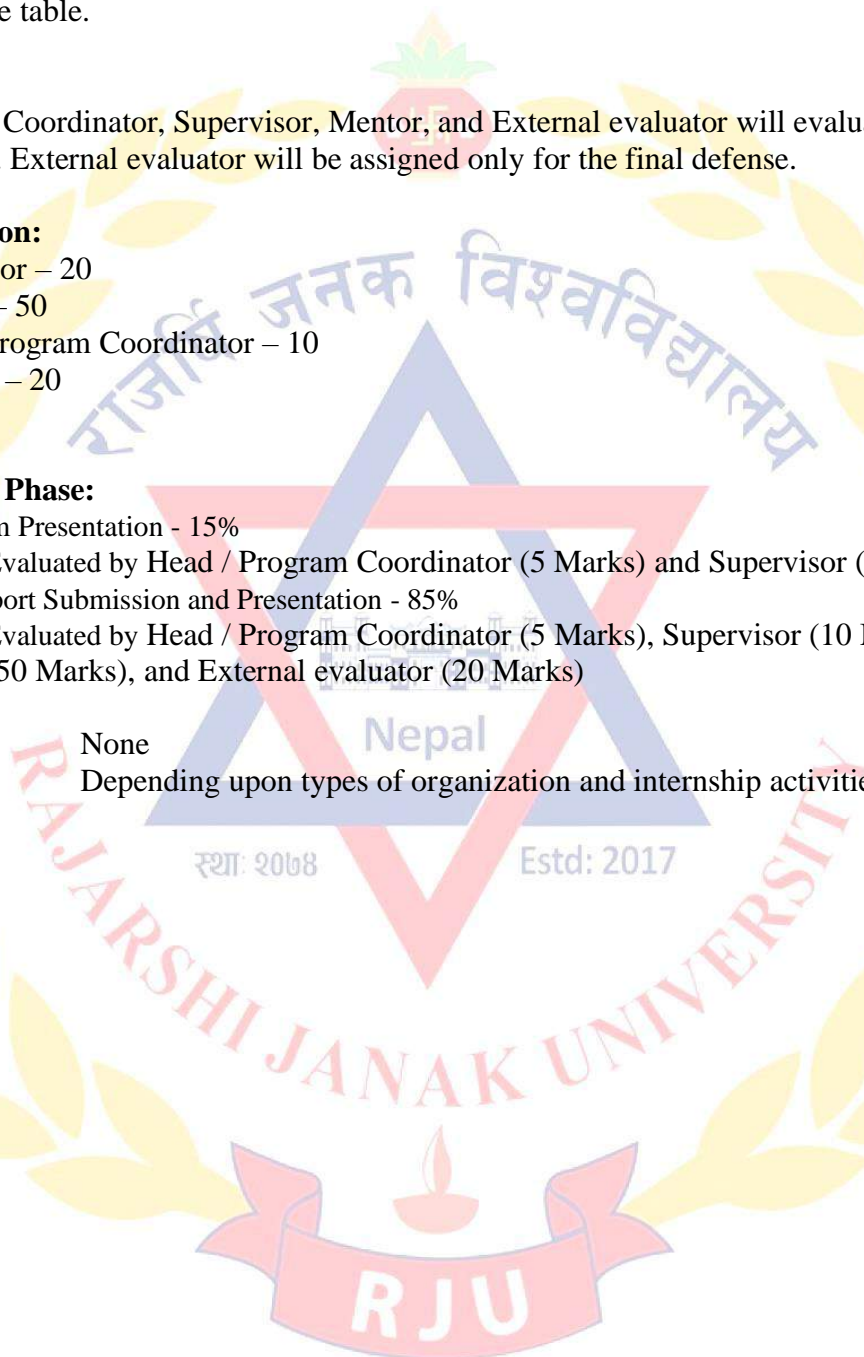
Course Title: Cloud Computing   **Credit hours: 3**
Course no: HCAC-471   **Full Marks: 60+20+20**
Nature of course: Theory+ practical   **Marks: 26 +8+8**

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Course objectives:
:
- To explore the principles and paradigm of Cloud Computing
- To illustrate the Service Model with reference to Cloud Computing
- To operate cloud Abstraction and Virtualization Technologies
- To demonstrate the design and deploy Cloud Infrastructure
- To discover the cloud security issues and solutions

Course Contents:

UNIT-I: Introduction to Cloud Computing   [6 Hrs.]
Introduction to Cloud Computing, History of Cloud Computing, Cloud-Based Services, Grid Computing vs Cloud Computing, Cloud Computing Deployment Models (Types), Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as aService Providers, Platform as a Service Providers, Challenges and Risks.

UNIT-II: Cloud Computing Architecture,   [9 Hrs.]

Exploring the Cloud Computing Stack, Connecting to the Cloud, **Service Modles**: Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frameworks, Software as a Service, Cloud **Deployment Models** : Public cloud, Private Cloud, Hybrid cloud, Community Cloud, Cloud Solutions, Cloud ecosystem, Service management, Computing on demand, Identity as a Service, Compliance as a Service.

UNIT-III: Abstraction and Virtualization   [10 Hrs.]
Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Center Automation

UNIT-IV: Service Oriented Architecture and the Cloud   [4 Hrs.]
Introduction to SOA, Enterprise Infrastructure and SOA, SOA components, SOA journey to Infrastructure, SOA and Infrastructure as a Service, Pairing SOA and Cloud services, SOA Defined: SOA lifecycle, Service-Oriented Computing, Serving the Business with SOA and Cloud Computing.

UNIT- V: Cloud Governance   [4 Hrs.]
Introduction to Cloud Governance, Governance for the Clouds, Service-Level Agreement and Compliance, Creating the Governance Model: Define policies, Design Policies, Implement Policies, Data Privacy and protection Risks, Risk Management, Governance Technology, The value of Service Governance.

UNIT-VI: Cloud Security   [8 Hrs.]
Security Overview, Cloud Security Challenges and Risks, Software-as-a- Service Security, Cloud computing security architecture: Architectural Considerations, General Issues Securing the Cloud, Securing Data, Data Security, Application Security, Virtual Machine Security.
Identity and Presence, Identity Management and Access Control, Autonomic Security Establishing

Trusted Cloud computing, Secure Execution Environments and Communications, , Identity Management and Access control Identity management, Access control, Autonomic Security Storage Area Networks, Disaster Recovery in Clouds

UNIT-VII: Cloud Based Case-Studies   [4 Hrs.]
     Overview of Cloud services, Designing Solutions for the Cloud, Implement & Integrate Solutions, Emerging Markets and the Cloud, Tools for Building Private Cloud: IaaS using Eucalyptus, PaaS on IaaS – AppScale

Text book:
1. Cloud Computing Unleashing Next Gen Infrastructure to Application, Dr.Kumar Sarurabh, Wiley
2. Cloud Computing for Dummies by Judith Hurwitz, Robin Bloor, Marcia Kaufman, And Dr. Fern Halper. Wiley Publishing.Inc

Reference Books:
3. Cloud Computing and SOA convergence in your Enterprise, David S.Linthicum
4. Rajkumar Buyya et. el., Cloud Computing: Principles and Paradigms, Wiley India Edition
5. Sosinsky B., "Cloud Computing Bible", Wiley India
6. Miller Michael, "Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online", Pearson Education India
7. Velte T., Velte A., Elsenpeter R., "Cloud Computing – A practical Approach", Tata McGrawHill

List of Experiments:
1. Sketch out and analyze architecture of Aneka / Eucalyptus / KVM identify different entities to understand the structure of it.
2. Create a scenario in Aneka / Eucalyptus to create a datacenter and host. Also create virtual machines with static configuration to run cloudlets on them.
3. Make and perform scenario to pause and resume the simulation in Aneka / Eucalyptus entity, and create simulation entities dynamically.
4. Organize a case in Aneka / Eucalyptus for simulation entities in run-time using a its toolkit support and manage virtual cloud.
5. Sketch out and analyze architecture of Microsoft Azure.
6. Sketch out and analyze architecture of Amazon Web Service (AWS).
7. Categorize Microsoft Azure Services and discuss on each.
8. Categorize Amazon Web Service (AWS) and implement its various cloud entities using its Cloud Toolbox support.
9. Implement and use sample cloud services with the help of Microsoft Azure.
10. Create a sample mobile application using Microsoft Azure account as a cloud service. Also provide database connectivity with implemented mobile application.
11. Create a sample mobile application using Amazon Web Service (AWS) account as a cloud service. Also provide database connectivity with implemented mobile application.
    minds to discovering the benefits of true cloud computing.

Major Equipment:

Cloud Environments like Aneka, Eucalyptus, AWS etc.

Course Title: Enterprise Resource Planning	Credit hours: 3
Course no: HCAMT-472	Full Marks: 60+20+20
Nature of course: Theory+ Practical	Pass Marks: 24+8+8

Course objectives:

- The course provides an overview of Enterprise Resource Planning (ERP) software systems and their role within an organization.
- It introduces key concepts integrated information systems and explains why such systems are valuable to businesses.
- It provides students with knowledge and understanding of the enterprise systems principles and the skills to manage enterprise systems.

Course contents:

UNIT-I: Introduction of ERP   [7 hrs.]

A Foundation for Understanding Enterprise Resource Planning Systems: The Emergence of Enterprise Resource Planning Systems – Business Benefits of ERP – ERP Modules – ERP Design Alternatives. Re-engineering and Enterprise Resource Planning Systems: Business Process Reengineering – Process Modeling – Re-engineering at Reliable Finance Company, Business modelling, integrated data model

UNIT-II: Planning, Design, and Implementation of ERP Systems   [10 hrs.]

Planning, Design, and Implementation of Enterprise Resource Planning Systems: Traditional Systems Development – new Approaches to Systems Development, The ERP Systems Development Process, ERP Implementation Steps, Roadmap for successful ERP implementation, ERP Systems: Sales and Marketing – Atlantic Manufacturing – #Management Control Processes in Sales and Marketing, ERP and Customer Relationship Management.

UNIT-III: Accounting and Finance system   [9 hrs.]

ERP Systems: Accounting and Finance: Management Control Processes in Accounting – Accounting and Finance Modules IN ERP Systems – the New Role for Management Accounting, Role of ERP in Sales and Distribution

ERP Systems: Production and Materials Management – Production Planning and Manufacturing Processes –Management Control Processes in Production and Manufacturing – Production Planning and Manufacturing Modules in ERP Systems – Materials Management Modules in ERP Systems.

UNIT-IV: Human Resources information system   [9 hrs.]

ERP Systems: Human Resources, Human Resources Data Administration, Compensation and Benefits Administration, Human Resources Information Systems, Human Resources Modules in ERP Systems, Integration of HR Modules with Other Modules. Managing an ERP Project: Risk Factors in Information Systems Projects, Risks in Implementing an ERP System, Managing Large-Scale ERP Projects, Project-Related Factors.

UNIT-V: Supply chain Management system [6 hrs.]

Supply Chain Management and the e-Marketplace: Supply Chain Management – e-Business and ERP – e-Supply Chain and ERP – Business Intelligence with ERP – Future Directions for ERP.

UNIT- VI: Future Directions in ERP [4 hrs.]

Future Directions in ERP: Emerging Trends in ERP, Development of New Markets and Channels, Modern ERP Implementation Methods, ERP and E-business, Market Snapshot.

Laboratory practical sessions on ERP.
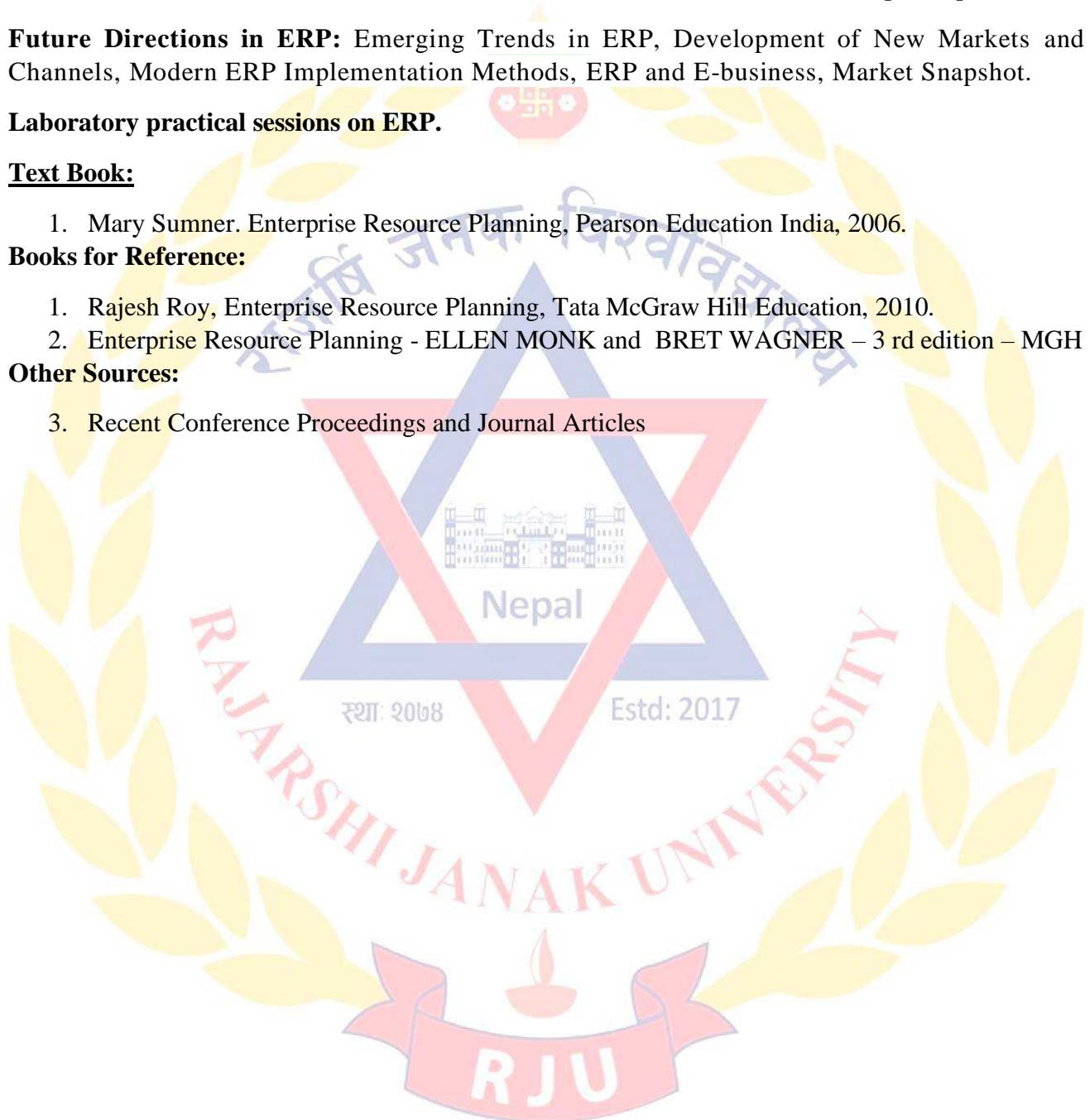
Text Book:

1. Mary Sumner. Enterprise Resource Planning, Pearson Education India, 2006.

Books for Reference:

1. Rajesh Roy, Enterprise Resource Planning, Tata McGraw Hill Education, 2010.
2. Enterprise Resource Planning - ELLEN MONK and BRET WAGNER – 3 rd edition – MGH

Other Sources:

3. Recent Conference Proceedings and Journal Articles

Course Title: Artificial Intelligence	Credit hours: 3
Course no: HCAC-473	Full Marks: 60+20+20
Nature of course: Theory+ practical	Pass Marks: 24+8+8

Course Objectives:

- To learn several types of algorithms useful in Artificial Intelligence (AI).
- To express the ideas in AI research and programming language related to emerging technology.
- To understand the concepts of machine learning, probabilistic reasoning, robotics, computer vision, and natural language processing.
- To understand the numerous applications and huge possibilities in the field of AI that go beyond the normal human imagination

Curse contents:

UNIT- I: Foundation [4 hrs.]

Intelligence and types, definitions of AI, history and applications of AI, relation of AI with other disciplines, Turing and reverse Turing test in AI, Types of AI, Tasks in AI, Human intelligence vs artificial intelligence, Intelligent Agents, Types of agents and environments

Unit II : Problem solving by searching and optimization [10 hrs.]

Search and exploration, Informed search strategies, heuristic function, local search algorithms and optimistic problems, local search in continuous spaces, online search agents and unknown environments, Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP, Structure of problems, Games: Optimal decisions in games, Alpha- Beta Pruning, imperfect real-time decision, games that include an element of chance.

Unit III : Knowledge representation and Reasoning [10 hrs.]

Structured knowledge representation: script, semantic net, frame,

Logic: rules of inference, types of statements, truth table based reasoning, Propositional logic, syntax, knowledge representation and reasoning using rules of inference, problem with propositional logic, first order logic, syntax, knowledge representation, reasoning using rules of inference, Reasoning: forward chaining and backward chaining, Resolution, case-based reasoning, Reasoning in uncertainty: Baysian network, Fuzzy logic

Unit IV: Learning [10. Hrs.]

Machine learning: learning agent revisit, learning from observation, Inductive learning, learning decision trees, Ensemble learning, Explanation based learning, Learning using relevant information,

learning with complete data, learning with hidden variable, EM algorithm, Instance based learning, Reinforcement learning,

Neural network and Deep learning: perceptron, activation functions, single layer and multilayer neural network, SVM, hopfield network, CNN, RNN, back propagation

UNIT-V: Applications [8 hrs.]

Computer vision: Image segmentation, feature extraction

Natural language processing: Natural language generation and understanding and their steps

Expert System: Introduction, Architecture and functionality, Example Expert system

Information retrieval : categorization and clustering, extraction and integration

UNIT-VI: Case studies [3 hrs.]

Case studies on current applications of AI in Bank and financial organizations, Medical Science, transportation, agriculture, computer network, cyber security, robotics, game playing and so on

Laboratory Work:

Laboratory exercises should be conducted in either LISP or PROLOG. Laboratory exercises must cover the fundamental search techniques, concept of knowledge representation.

Text Books

1. Stuart Russell, Peter Norvig, "Artificial Intelligence", A Modern Approach, Pearson Education/Prentice Hall of India.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill.

Reference Books

1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd.
2. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education/ PHI

Course Title: Graphical Information system	**Credit hours: 3**
Course no: HCAC-474	**Full Marks: 60+20+2**
Nature of course: Theory + Practical	**Marks: 24+8+8**

Course objectives:

- This course aims to provide the basic concept of geographic information systems (GIS), their components, and applications.
- Students will obtain a basic understanding of GIS, learn the operational process to get the specified outcome, gain the skills for the spatial data collection and creation, editing them, and building the metadata and visualization of the spatial dataset.

Course contents:

UNIT-I: Introduction to GIS   [3 Hrs.]

Overview, history and concepts of GIS, Purpose and benefits of GIS, Scope and application areas of GIS, Functional components of GIS, Uses of GPS and remote sensing data in GIS

UNIT-II: Spatial Data Model and database design   [9 Hrs.]

Concept of data model, Vector data model, Raster data model, Other data models: Triangulated irregular networks, Object data models, Multiple models, Spatial database design with the concepts of geodatabase

UNIT-III: Coordinate systems, map projection and visualization   [9 Hrs.]

Coordinate system, Projection systems, Datum and datum transformation, Map elements, map layers, map scales and representation, Map, Exporting map in different format

UNIT-IV: Spatial Data Analysis   [15 hrs.]

Vector based analysis: Vector data editing, geocoding, Selection and classification, Dissolve, Proximity functions and buffering, overlay: clip, intersect, merge, union etc.

Raster based analysis: Map algebra, Spatial interpolation methods, Integrated spatial analysis, classification function, reclassification etc.

UNIT -V: Data Infrastructure   [3 Hrs.]

SDI concepts and its current trend, the concept of metadata and clearing house, Critical factors around SDIs

UNIT-VI: Open GIS [6 Hrs.]

Introduction of open concept in GIS, Open Standards for GIS: Open Source GIS e.g. OpenStreetMap, Web Based GIS system

Laboratory work:

Data collection, management and analyses of geographical data in a GIS

TEXT BOOKS

- Bolstad, P. (2016). *GIS Fundamentals: A First Text on Geographic Information Systems*, (5th Edition.), XanEdu Publishing Inc.
- Ormsby, T. et al. (2008). *Getting to Know ArcGIS Desktop* (2nd Edition), Environmental Systems Research Inc. (ESRI), weblink: https://esripress.esri.com/display/index.cfm?fuseaction=display&websiteID=350&moduleID=0
- Huisman, O. & De, R.A. (2008). *Principles of geographic information systems: An introductory textbook edited by GIS Fundamentals: A First Text on Geographic Information Systems* (4th Edition), International institute for Geo-information science and Earth observation, the Netherlands, weblink: https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf

References:

- Longley, P. A. et al. (2015). Geographic Information Systems and Science (4th Edition), Wiley.
- Kang-tsung Chang, (2007). 'Introduction to Geographic Information Systems' Tata McGraw Hill, New Delhi.
- C.P.Lo and Albert K.W.Yeung (2006). "Concepts and Techniques of Geographic Information Systems" Prentice Hall of India,New Delhi

Course Title: Data Warehousing and Data Mining   **Credit hours: 3**
Course no: HCAC-475   **Full Marks: 60+20+20**
Nature of course: Theory + Practical   **Marks: 24+8+8**

Course objectives:

- To impart knowledge about various data repository architecture and data warehouse Schema
- To introduce basic concepts and techniques of data mining.
- To apply Data Mining algorithms and techniques in solving data mining problems

Course contents:

UNIT-I: Introduction   [4 Hrs.]

Basics of Data Mining, Knowledge Discovery in Databases, Data Mining Issues and Challenges, Application of Data Mining

UNIT-II: Data Warehousing   [12 Hrs.]

Database vs Data Warehouse, Multi-dimensional Data Model, DW Schema – Star, Snowflake and Galaxy, Data Warehouse Architecture, Enterprise DW Server, Data Mart, Virtual DW Server, Data Cube, OLAP Operation – Slicing, Dicing, Drilling, Pivoting.

UNIT-III: Association Rules   [6 Hrs.]

Market Basket Analysis: Transactions, Items, Support and Confidence, Association Rule, Frequent Item Set, Infrequent Item Set, Maximal Set, Border Set, A-priori Algorithm.

UNIT-IV: Classification Method   [8 Hrs.]

Supervised Learning, Decision Tree, Naive Bayes Classification, Statistical-Based Algorithms, Prediction, Rule-Based Algorithms, Classification Software.

UNIT-V: Clustering Technique   [8 Hrs.]

Unsupervised Learning, Distance Metrics for Clustering, Partitioning Method – kMeans and kMedoids algorithms, Hierarchical Methods, Clustering Software.

UNIT- VI: Advanced Topics   [7 Hrs.]

Genetic Algorithms, Artificial Neural Network, Support Vector Machine, Web Mining

Lab Works:

- Setup a data warehouse by using an appropriate tool like xMondrian, Pentaho, IBM's BI Tool etc.

- Implement OLAP operation on a data cube.

- Demonstrate data mining algorithms learned in Unit III, Unit IV, and Unit V

Text Book:

1. Kamber and Han, "Data Mining Concepts and Techniques", Hartcourt India P. Ltd.,2001.

2. Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons, 2003.reams with Advanced Analytics, Wiley, 2012

Reference Book

1. Data Mining: Concept and Techniques Han Elsevier ISBN :978938031913

2. Margaret H. Dunham , S. Shridhar Data Mining- Introductory and Advanced topics Pearson education

3. Tom Mitchell- machine learning McGraw hill 1997
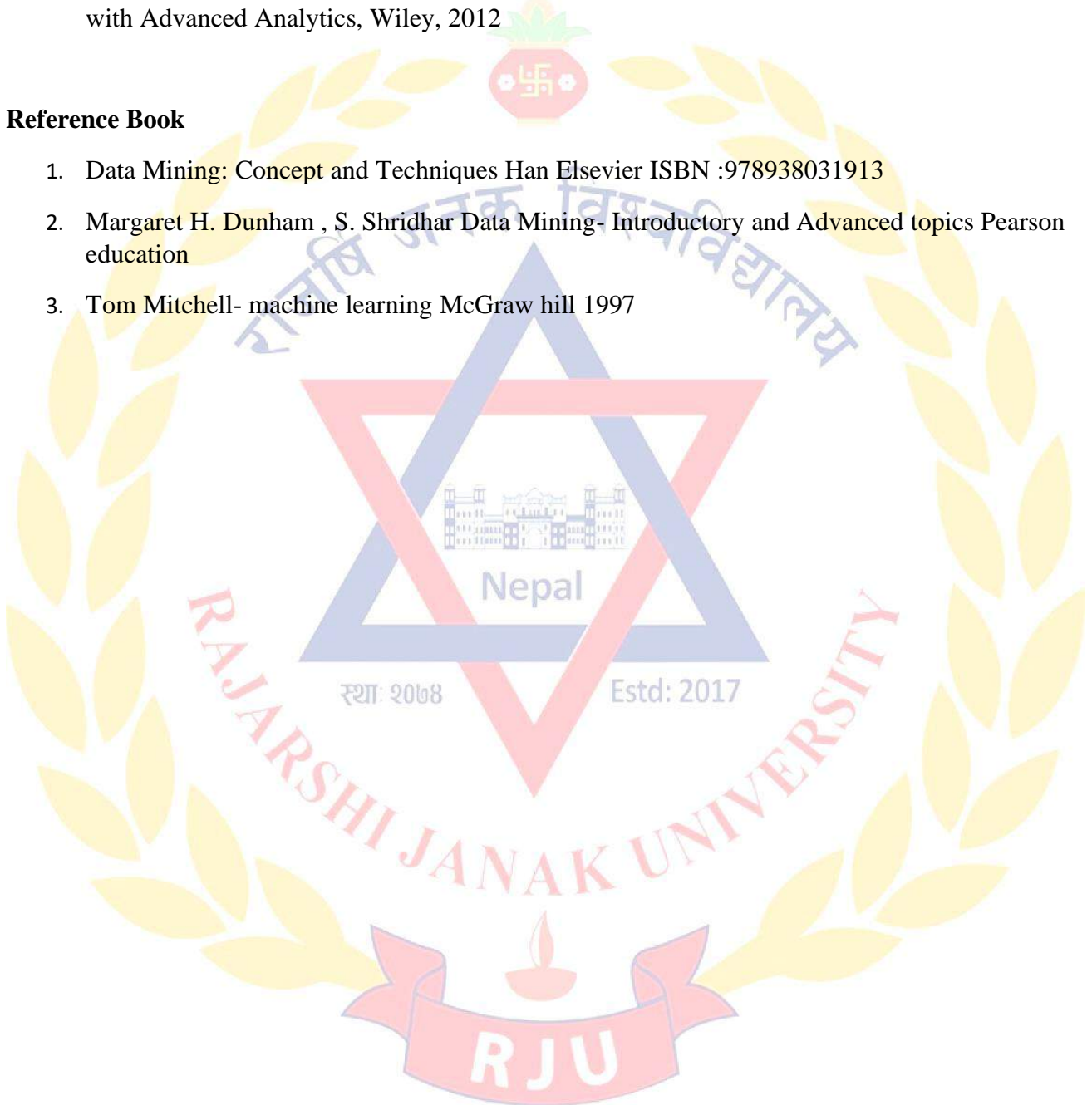
Course Title: Mobile programming
Course no: HCAC-451   **Credit hours: 3**
Year / Part: IV/VIII   **Full Marks: 60+20+20**
Nature of course: Theory+ Practical   **Pass Marks:24+8+8**

Course Objectives:

- The major objective of this course is to make students familiar with Design and Develop Android application by setting up Android development environment

Course contents:

UNIT - I: Introduction   [8 Hrs.]

Introduction and Objectives of Mobile Applications, Evolution, Implementation Technology, Native Application Implementation, Mobile Web Applications, Hybrid Mobile Application Implementation

UNIT - II: Design Issues and Considerations   [10 Hrs.]

Mobile Development Lifecycle, Form Factors and User Input Technology, Architecture, Design and Engineering Considerations, Usability and User Interaction Design, Mobile Navigation and Interface Design, Overarching Design Principles and Guidelines

UNIT - III: Mobile Data Management   [7 Hrs.]

Content Providers: Contents provider, Uri, CRUD access, Browser, CallLog, Contacts, Media Store, and Setting. Data Access and Storage: Shared Preferences, Storage External, Network Connection.

UNIT - III: Developing the Mobile App   [10 Hrs.]

Techniques, Methodologies, Development Frameworks, Persistent Data in Mobile Apps, Maps and Location in Mobile Apps, Access to Hardware and Sensors, Building Mobile Apps Powered by Enterprise Backend, Secured Data Store and Synchronization

UNIT -IV: Testing and Publishing Apps   [10 Hrs.]

Basics of Testing, Activity testing, Service testing, Content provider testing, Test Classes, Debugging using DDMS, Mobile Application Build and Delivery, Testing Mobile Applications, Automated versus Manual Testing, App Distribution through App Stores, App Distribution for the Enterprise, Monetizing Apps

Labs Works:

The Laboratory exercise will cover all the topics mentioned. Students are encouraged to design and implement an android application as a project work.

Text/Reference Book:

- Leigh Williamson et. al (2015). Enterprise Class Mobile Application Development: A Complete Lifecycle Approach for Producing Mobile Apps.
- Jakob Iversen (2013). Learning Mobile App Development: A Hands-on Guide to Building Apps with iOS and Android.
- Sachin Date (2015). An Illustrated Guide to Mobile Technology.

Course Title	: Project III	
Course No	: HCAPJ-452	Credit Hours: 6
Year/Semester	: IV/VIII	Full Marks: 200
Nature of course	: Project	Pass Marks: 80

Course Objective:

- The main objective of this course is to develop both theoretical and practical skills needed to develop high quality real world ready to use software application using suitable software development methodology, alternate style, and implementation techniques and tools.

Course Description:

- This is the final major project work of the BCA program that covers different theoretical and practical aspects needed to develop ready to use real world software applications useful for general public or organizations.
- This course focuses in enabling students with the skills pertaining to the development of software applications including planning, analysis, design, and implementation activities.
- The project can be done in a group preferably with **FOUR / FIVE** members in each group. Students are highly recommended to work in group projects as group projects help them develop a host of skills that are increasingly important in the professional world. Positive group experiences, moreover, have been shown to contribute to student learning, retention and overall success. A supervisor is assigned to supervise each student during project in the college.

Phases: The overall project work is divided into three phases:
8. Proposal Submission and Presentation
9. Mid-Term Presentation
10. Final Report Submission and Presentation

8. Proposal Submission and Presentation:

- The project team prepares proposal document in the prescribed format and submits to the college
- The panel coordinated by Head / Program Coordinator evaluates the proposal along with presentation from the student(s)
- If the proposal is accepted, a supervisor is assigned by the HOD / Program Coordinator depending upon the nature of the project

9. Mid-Term Presentation:

- The project team has to present their progress on the project in front of Head / Program Coordinator, Supervisor, and Internal Evaluator in the middle of the semester after completing approximately 50% of the project work.

10. Final Report Submission and Presentation:

- After submitting the final project report prepared in the prescribed format, the Project team has to present their final project in front of Head / Program Coordinator, Supervisor, Internal Evaluator and External Evaluator.

Proposal Contents:

- Title Page
- Introduction
    - Introduction
    - Problem Statement
    - Objective
    - Scope and limitation
- Methodology
    - Requirement Identification and Feasibility Study
    - Related Work / Literature Review
    - Analysis and Design Tools
    - Implementation tools (Front End, Back End)
- Expected Outcome
- Project Schedule
- References / Bibliography

Report Contents:

- Title Page
    - A standardized page for specifying the title and author of the work
- Certificate of Authorship
    - Declaration that the work reported is the original work
- Approval Sheet
    - Recommendation for approval from Head / Program Coordinator, Supervisor, External and Internal evaluators
- Acknowledgements
    - Thanking anyone who has helped you in any way
- Abstract
    - Giving a short overview of the work
- Table of Contents
    - Giving page numbers for all major section headings
- List of Figures
    - Giving page numbers for all the figures
- List of Tables
    - Giving page numbers for all the tables
- List of Abbreviations
    - List of abbreviations
- Introduction (Chapter I)
    - Introduction: Introduce the organization (if any) and the work
    - Problem Statement: Explain why you are doing this work and what is the problem being solved
    - Aims and Objectives: Clearly explain aims and objectives and scope of your work
    - System Development: Explain in brief about systems development, systems development methodology, and alternative approaches
    - Report Organization: Explain in brief about organization of your report
- Related Work / Literature Review (Chapter II)
    - Explain the current state of the art in your area

- o Explain the works other have people done (published or commercial) that is relevant to yours
  - Analysis (Chapter III):
    - o Determining system requirements and studying feasibility
    - o Chose suitable approach (structured or object-oriented)
  - Design (Chapter IV)
    - o Convert analysis document into design specifications
  - Implementation (Chapter V)
    - o Coding: Design specifications are turned into working computer code using suitable programming language, database technology, and interfacing technology
    - o Testing: Tests are performed using various strategies; A master test plan is developed during the analysis phase; During the design phase, *unit*, *system* and *integration* test plans are developed; The actual testing is done during implementation
  - Conclusion and Future Work (Chapter VI)
    - o Explain what conclusions you have come to as a result of doing this work and any future plan to extend the work
  - References / Bibliography:
    - o Provide a list of papers, books and other publications that are explicitly referred to in the text
    - o Use IEEE citation style
  - Appendices:
    - o Supplementary material should be included in appendices - these are optional, but they might contain:
    - o Code listings – A listing of the code you have written for the project. You should NOT include code listings for code you have not written!! If your project involves modifying code previously written by others, then you may include this other code as long as you indicate clearly in the code listing what parts have been written by you.
    - o Raw data – If your work involves data collection then this should usually be included in appendices. This should provide supporting evidence for claims made in the main part of the work (e.g., copies of a user evaluation questionnaire and some sample responses).
    - o Examples of test data
    - o Electronic material on a CD/DVD/Pen Drive inside the back cover. This might contain executable software, source code, graphics, slides used for your presentation, etc. Where the appendices are long (e.g. code listings) do not print them out, rather provide them on a CD/DVD/Pen Drive

Report Format:
- Page Number
  The pages containing certificate of approval to the page containing list of abbreviations should be numbered in roman starting from i. The pages starting from Chapter 1 onwards should be numbered in numeric starting from 1. Page numbers should be inserted at the bottom of the page and aligned centre.
- Paper Size and Margin
  The paper size should be A4 and the margins must be set as:
  - o Top = 1 in (2.54 cm)
  - o Bottom = 1 in (2.54 cm)

- o Left = 1.25 in (3.17 cm)
  - o Right = 1 in (2.54 cm)
- Paragraph
  All paragraphs must be indented and justified (both left-justified and right-justified). All the paragraphs must be written using Times New Roman font with font size 12 and 1.5 paragraph spacing.
- Heading
  No more than 3 levels of headings should be used. Font size for the heading should be 16 for chapter title, 14 for section headings and 12 for subsection headings. All the headings should be bold faced.
- Figures and Tables
  Figure captions should be centred below the figures and table captions should be centred above the table.

Evaluation:

Head / Program Coordinator, Supervisor, Internal and External evaluators will evaluate the overall project work. External evaluator will be assigned only for the final defense.

Marks Allocation:
- Supervisor – 120
- Internal Evaluator – 20
- Head / Program Coordinator – 20
- External   40

Total – 200

Weight of each Phase:
- Proposal Submission and Presentation - 10%
  - o Evaluated by Head / Program Coordinator (4 Marks), Supervisor (12 Marks), and Internal (4 Marks)
- Mid-Term Presentation - 20%
  - o Evaluated by Head / Program Coordinator (6 Marks), Supervisor (28 Marks), and Internal evaluator (6 Marks)
- Final Report Submission and Presentation - 70%
  - o Evaluated by Head / Program Coordinator (10 Marks), Supervisor (80 Marks), Internal evaluator (10 Marks), and External evaluator (40 Marks)

Text Books: None

Prerequisite: Depending upon types of project

Course Title: Database Administration	Credit hours: 3
Course no: HCAC-481	Full Marks: 60+20+20
Nature of course: Theory+ Practical	Pass Marks: 24+8+8

Course objectives:

Students will be familiar with all the concepts and ideas used in database administration. They will gain hands-on experience practicing security procedures and using administrative tools. They can implement recovery techniques, backups and setup programs to check for malicious software's.

Course contents:

UNIT - I: Data Administration   [10 Hrs.]

Data Administration Tasks, Database Design, Performance Monitoring and Tuning, Installation Verification, DBMS Environments, Upgrading DBMS Versions and Releases, Features and Complexity, Complexity of the DBMS Environment, Reputation of the DBMS Vendor, Support Policies of the DBMS, DBMS architecture and data independence, DBA roles and responsibilities, SQL PLUS, Producing more readable outputs, Accepting values at runtime

UNIT – II: Log File Management: [6 Hrs.]

Introduction to Control and Redo Log Files, Managing the control files, Maintaining and monitoring redo log files, Multiplexing redo log files, Archiving log files

UNIT- III: Managing users and security: [8 Hrs.]

Profiling and Managing users, managing user privileges and roles, Managing and querying role information, Database Security and Auditing, Creating and managing DB objects, Tables, indexes, triggers, views, stored procedures, etc., Transaction concurrency management

UNIT - IV: DB Backup and Recovery: [5 Hrs.]

Backup and Recovery Overview, Database backup, restoration and recovery, defining of backup and recovery procedure, Testing the backup and recovery plan, Parallel instance recovery, recovering from non-critical loses

UNIT – V: Oracle Recovery Manager (RMAN):   [6 Hrs.]

Database corruption, automatic storage management, RMAN configuration, Database Archival

UNIT - VI: DB Performance Tuning   [10 Hrs.]

Introduction, Tuning methodology, Tuning concepts, AADM (Automatic Database Diagnostic Monitor), SQL Tuning Advisor, AWR Report, Virtual Private Database, Policy types, selective columns, column masking

Laboratory works:

1. Installation of Oracle Database
2. Database Creation
3. User Creation
4. Role, Privileges and group management
5. Database object creation

      Tables, Indexes, Views, Triggers, Stored Procedures, Function, Package, etc.
6. Database Backup

      Online backup, Offline backup
7. DB Recovery technique

      Export and Import utility, Data Pump, Data guard
8. RMAN
9. Database Archiving
10. Performance Tuning

      ADDM Report, AWR Report, Spot Light, OEM

Text/Reference Books:

1. Introduction to Database Administration, by O'reilly
2. Oracle Database Administration: The Essential Referene by David C. Kreines and Bran Laskey
3. Database Administration, The Complete Guide to DBA Practices and Procedures, Second Edition by Craig S. Mullins
4. C.J. Date, Database Systems, Addison Wesley, 2000

Course Title: Network Management and Administration	Credit hours: 3
Course no: HCAC-482	Full Mark: 60+20+20
Nature of course: Theory + Practical	Pass Mark: 24+8+8

Course objectives:

- The major objectives of this course is to make students familiar with the fundamentals of network management, primarily for TCP/IP networks and to design, install, configure and experience hands-on management of typical network components.

Course content:

UNIT – I: Exploring Directory Services and Remote Access   [8 Hrs.]

Introduction, Novell Directory, Windows Domain, MS Active Directory, X500 Directory Access Protocol, Lightweight Directory Access Protocol, Forests, Trees, Roots and Leaves, Active Directory Architecture: Object Types, Object Naming, Canonical Names, LDAP Notation, Globally unique identifiers, User Principle Names, Domain, Trees & Forests, Remote Network Access: Need of Remote Network Access, PSTN, ISDN, DSL, CATV., Virtual Private Network: VPN Protocols, Types of VPN, VPN Clients, SSL VPNs.

UNIT – II: Network Protocols and Services   [12 Hrs.]

Dynamic Host Control Protocol(DHCP), DHCP Origins, Reverse Address Resolution Protocol (RARP), The Bootstrap Protocol (BOOTP), DHCP Objectives, IP Address assignments, DHCP , Architecture, Domain Name Systems (DNS): Objectives, Naming, Top Level Domains, Second Level Domains, Sub-domains, DNS Functions, Resource Records, DNS Name Resolution, Resolves, DNS Requests, Root Name Servers, Resolving a Domain Name, DNS Name Registration.

Network Printing Concepts: Locally Connected Print Devices, setting up local Print Devices, Shared Print Devices, Sharing Locally Attached Print Devices, Describe Windows Network Printing and Add print Wizard.

UNIT – III: Designing Network   [12 Hrs.]
Accessing Network Needs, Applications, Users, Network Services, Security and Safety, Growth and Capacity Planning, Meeting Network Needs – Choosing Network Type, Choosing Network Structure, Choosing Servers.
Network Planning and Implementation, Installing and Configuring Windows Server - Preparing for Installation, Server Concepts: WEB, Proxy, RADIUS, MAIL, Cookies, Load Balancing Proxy Arrays, Server Setup and Configuration Guidelines, Security and System Administration Issues, Firewall and content filtering
Creating windows server boot disk, installing windows server, configuring server/ client, set up windows server - Domain controller, Adding the DHCP and WINS roles, adding file server and print server, Adding Web based Administration.

UNIT – IV: **Network Configuration**   **[8 Hrs.]**

Working with User Accounts: Adding a User, Modifying User Account, Deleting or Disabling a User Account, Working with Windows Security Groups: Creating Group, Maintaining Group Membership, Working with Shares: Understanding Share Security, Cresting Shares, Mapping Drives Administering Printer Shares, setting up Network Printer,   Working with Windows Backup: Using Windows Servers Backup Software.

UNIT – V: Troubleshooting of Networking   **[5 Hrs.]**

Understanding the Problem: Troubleshooting, Segmenting the Problem, and Isolating the Problem, Setting Priorities, Troubleshooting Tools: Hardware Tools, Software Tools, Monitoring and Troubleshooting Tools, Internal Security: Account Security, File and Directory permissions, Practices and user education.

LAB Works: The practical covers all the topics mentioned in all units.

Reference books:
1. The Complete Reference Networking, Craig Zacker, Tata McGraw Hill
2. The Real World Network Troubleshooting Manual, Alan Sugano, Firewall Media
3. Networking A Beginner's Guide, Bruce Hallberg, Tata McGraw-Hill
4. Introduction to Networking, Bruce Hallberg, Tata McGraw-Hill
5. Networking + Certification Training Kit, Richard A. McMahon, Sir Microsoft Press
6. MCSE Training Kit Networking Essential Plus, Microsoft Press, MicroSoft Press

Course Title: Linux Shell Programming	Full Marks: 60+20+20
Course no: HCAC-483	Pass Marks: 24+8+8
Nature of course: Theory + Practical	Credit hours: 3

Course objectives:

- The main objective of this course is to impart students with the fundamental idea of the Shell Programming using BASH in Linux.
- This course also delivers to students the basic knowledge of Unix/Linux operating system viz. basic commands, text editor, file and directory structure, shell environment and shell scripts etc.

Course contents:

Unit 1:Introduction to Unix / Linux [3 hrs.]

History of UNIX, Unix and Linux; Unix vs. Linux; GUI and Virtual tty Terminals, Login Shell; Unix Culture and Getting Help - man, whatis, apropos, info; Initial Commands of Linux – login, logout, exit, date, passwd, su, sudo, reboot, shutdown; Finding a Program - which, type, whereis; Use of commands - vlock and leave; Getting System Information - uptime, hostname, uname; Getting User's Information – whoami, users, who, w, id, last.

Unit 2: Files and Directories [6 hrs.]

Listing file and displaying its contents– ls, cat, wc, more, less, echo; File Handling – touch, cp, mv, rm; Text Editor – vim and the default text editor of Linux distro, Working with Directories – pwd, mkdir, cd, rmdir; Creating a Link of file / directory – ln; Filename Substitution and Meta characters, I/O, Error and Redirection - |, >, >>, <, 2>, $?.

Unit 3: Linux Commands and Tools [3 hrs.]

A few Simple Tools with their usage – cut, paste, tr, sort, uniq, cal and calendar, bc, dc etc. Sending Commands to run in background - &.

Unit 4: Shell Programming Basics [9 hrs.]

Command Interpreter and Shell Script; Shell's Responsibilities; Interactive and Non-interactive Shell; Bourne Shell Family: sh, ksh, bash; C-Shell Family: csh, tcsh; Changing a Shell - $SHELL, sh, bash, ksh, csh; Environment Variable and Shell Variable – env, printenv, set, unset; Regular Expression - ed, sed, grep;,

Unit 5: Shell Scripts [9 hrs.]

Writing a Shell Script - #!/bin/bash, File Attribute and Permission – chmod; Running a Shell script - . /; Built-in Integer Arithmetic, Quotes and Metacharacters – single quote, double quotes, back quote, back slash; Command Substitution, Arguments – $#, $@, $*, shift, ${n}.

Unit 6: Decisions [6 hrs.]

If Construct – if...then...fi, if…then...else…fi, ...elif…; Exit Status - exit; Test Commands, - test expr, [expr]; Logical Operators; Case construct, Null command - :, only "if" and only "not if" - &&, ||.

Unit 7: Looping   [6 hrs.]

For Loop Construct – for with lists, for with arguments, for without arguments; While Loop Construct; Until Loop Construct; Break and Continue, User Input – read; Loop options – semicolon (;), &, >, 2>, | ; Getting Options – getopts.

Unit 8: Printing and Formatting   [3 hrs.]

echo with Escape Characters, printf with conversion and formatting codes.

Laboratory Works:
Practical classes should cover all the commands and concepts mentioned all units by using any Linux distribution like Ubuntu, Fedora, etc., which supports BASH shell.

Text Books:
1. Harley Hahn, Harley Hahn's Guide to Unix and Linux, McGraw-Hill ISBN: 978-0-07-313361-2
2. Kochan and Wood, UNIX Shell Programming, Hayden Books ISBN: 0-672-32490-3

Reference Books:
1. E. Quigley, UNIX Shells by Example, (2nd ed), Prentice Hall, 2000.
2. A. Robbins, O'Reilly,UNIX in a Nutshell, 1999.

Course Title: Distributed system	Credit hours: 3
Course no: HCAC-484	Full Marks: 60+20+20
Nature of course: Theory + Practical	20Pass Marks: 24+8+8

Course Objectives:

- The main objective of this course is to be familiar with fundamentals of distributed systems and design, Middleware and various issues in designing distributed algorithms.

Course contents:

UNIT - I: Introduction   [5 hrs.]

Definition, Examples, Goals, Advantages, Hardware and Software Concepts, Design Issues, Models, Resource Sharing and Web

UNIT – II: Communication   [6 hrs.]

Introduction, Communication between distributed object, IDL, Remote Procedure Call, JAVA RMI and case study, Events and Notification

Unit – III: Distributed File Systems   [6 hrs.]

Introduction, Distributed File System Design, Distributed File System Implementation, Stateful and Stateless Service, NFS architecture, Google File system, HDFS and its architecture

UNIT - IV: Operating System Support and Heterogeneous Applications   [5 hrs.]

Operating system layer, Process and threads, Monolithic and Microkernel architecture, Heterogeneity in distributed system, Middleware, CORBA and its architecture, CORBA services

UNIT- V: Synchronization and Coordination   [8 hrs.]

Physical and Logical Clock, Physical Clock Synchronization Algorithm, Lamport and Vector Clock, Distributed Mutual Exclusion, Token based and Non Token based algorithms, Election Algorithms

UNIT – VI: Transaction and Concurrency control   [8 hrs.]

Properties of Transaction, Nested and Distributed Transaction, Locking and Timestamp based Concurrency control algorithms, two phase locking, variations in 2PL, Schedule, Atomic Commit Protocols, Transaction Recovery, Deadlocks handling strategies in Distributed Systems, Transaction Recovery

UNIT – VII: Replication and Fault Tolerance   [7 hrs.]

Introduction to Fault tolerance, Replication as fault tolerance, Active and Passive replication models, Process Resilience, Two Army Problem, Byzantine Generals problem, Reliable client server communication,

Laboratory Works:

The Laboratory exercise will cover the topics:

- NFS Implementation
- RPC and RMI Implementation
- Clock Synchronization Algorithms
- Mutual Exclusion Algorithms (Token and Non Token Based)
- Election Algorithms

Text/ Reference Books:

- Coulouris, G., Dollimore, J., Kindberg, T., and Blair G., Distributed Systems: Concepts and Design, Addison-Wesley, Fifth Edition, 2011.
- Singhal Mukesh, Shivaratri G Niranjan, Advanced Concepts In Operating Systems Distributed Data Base, And Multiprocessor Operating Systems, McGraw-Hill, Inc., 2009.
- Tanenbaum and M. Steen, Distributed systems: principles and paradigms, PHI, Second Edition, 2013.

Course Title: Advance .Net Technology	**Credit Hours: 3**
Course Code: HCAC-485	**Full Marks: 60+20+20**
Nature of course: Theory + Practical	**Pass Marks: 24+8+8**

Course Objectives:

- The objective of this course is to provide advance level skills and knowledge to students in .NET programming using high-level abstractions, Class Library, develop dynamic web pages using ASP.NET, and introduce the WPF, WCF, WF, Silverlight, and Ajax Controls.

Course Contents:

UNIT - I: Working with .NET   [2 Hrs.]

.NET Framework architecture, Name spaces, Exploring Assemblies and Namespaces, Common Language Implementation, Metadata and Intermediate Language, Garbage Collection, Versioning and Side-by-Side Execution, The End to DLL Hell - Managed Execution, COM Interop.

UNIT – II: Data Types and Base Class Libraries   [6 Hrs.]

.NET Data Types, The Microsoft. Visual Basic Namespace, Stream and String, manipulation, Files and I/O, Collections, Multithreading

UNIT – III: Object Oriented Programming using VB.NET and C#   [4 Hrs.]

Introduction to VB.NET and C#, Namespaces, Creating Classes, Classes and Inheritance, Overloading, Constructors and Destructors, Inheritance, controlling scope and visibility, Dispose and Finalization, Modifiers, Properties and Indexers, Attributes, Reflection API, Unsafe Code, Delegates, Lambdas, Events.

UNIT – IV: Windows Application: [6 Hrs.]

Language Features Creating .NET Projects, Namespaces, Debugging and Error Handling, Structured Error Handling, Windows Forms: Benefits, Windows Form Controls, Properties and Events, .NET Events, MDI Form, Visual Inheritance, Application of Inheritance techniques to Forms, Dialogs, ToolTips, Resizing, Menus, Custom control creation, Using ActiveX Controls, Printing, Handling Multiple Events, GDI+

UNIT– V: ADO.NET   [3 Hrs.]
Benefits of ADO.NET, ADO.NET compared to classic ADO, ADO.NET Objects Working with Data Sets, Managed Providers, Data Binding, Data Sets and XML, Typed Data Sets, Working with Data Reader, LINQ

UNIT – VI: ASP.Net and Web Development   [8 Hrs.]
Introduction to ASP.NET, Difference between ASP and ASP .Net, Controls, Rich Server Controls, Web Site Administration Tool, Configuration Overview, Programming Configuration Files, Encrypting Configuration Sections, Database accessing, List- Bound Controls, Repeater Control, DataList Control

State Management: Preserving State in Web Applications, Page-Level State, Using Cookies, ASP.NET Session State, Storing Objects in Session State, Configuring Session State, an Out-of-Process State Server, Session State in SQL Server, Using Cookieless Session IDs, Application State

Themes and Master Pages: Consistent Web Site, CSS and Scene files, Master Pages: Content place holder and Nested Master page.

Web Services: XML Web Services, Creating and Designing an XML Web Service, Creating Web Service Consumers, Discovering Web Services Using UDDI

UNIT – VII: Advanced Concepts   [12 Hrs.]

WPF: Introduction, create WPF application, Windows Client .NET, WPF programming model features (XAML, Layout, Dependency Properties, Styling and Templating), WPF Features (Controls, Data Binding, Input, Graphics and Multimedia, Security)

WCF: Framework, WCF Address, WCF Binding, Wshttp, Basic http, Nettcp, netPeertcp,Msmq, WCF Contract, Service Contract, Operaton Contract, Data Contract, Service Hosting, IIS Hosting, Local host (Service Host), Broadcasting, Messaging, Data Base Servicing, WCFtestclient tool, Svcconfigeditor tool, Svcutil Tool

WF: Intrssoduction, choosing right WF tool, WF4, Binding first WF
SilverLight: Framework, Component's, Control & Component Events, Styles and Templates, Working with Data, Silverlight enabled Web services, Data Binding & Events, Integration with ASP.NET

Ajax Controls: AJAX and need for AJAX, Implement with JavaScript, ASP.NET AJAX – Update Panel, Update Progress etc., ASP.NET Ajax Control toolkit, Client-side Template Rendering – Data View control

UNIT – VIII: Dot Net Nuke   [4 Hrs.]
   Introduction, Modules, skins, DotNetNuke latest version features.

Laboratory Work: Develop a complete web-based project on the topic provided/suggested/accepted by subject teacher.

Text /Reference Books:
   1. Professional ASP.NET 4.5 in C# and VB, Wrox publication.
   2. Professional C# .Net, Wrox publication
   3. Troelsen, Andrew, Japikse, Philip, " Pro C# 8 with .NET Core 3", Apress, 2020.
   4. Chirag Patel, "Advance .Net Technology", Dreamtech
   5. Publication ASP.NET complete reference, TMH
   6. Stephen Walther, Kevin Hoffman, Nate Dudek, "ASP.NET 4, Unleashed" Pearson
   7. C# 2012 programming, covers .net 4.5, black book, KOGENT learning solutions inc., Dreamtech Pub.

Course Title: BIG DATA   **Credit hours: 3**
Course no: HCAC-486   **Full Marks: 60+20+20**
Nature of course: Theory + Lab   **Pass Marks: 24+8+8**

Course objectives:

- To introduce student to current scenarios of big data and provide various facets of big data.
- It also provides them with technologies playing key role in it and equips them with necessary knowledge to use them for solving various big data problems in different domains.

Course Contents:

UNIT -I: Introduction to Big Data   [8 Hrs.]

Big Data Overview, Background of Data Analytics, Role of Distributed System in Big Data, Role of Data Scientist, Current Trend in Big Data Analytics, Big data stack, Big data distribution packages

UNIT - II: Google File System   **[7 Hrs.]**

Architecture, Availability, Fault tolerance, Optimization for large scale data

UNIT -III: Map-Reduce Framework   **[10 Hrs.]**

Basics of functional programming, Fundamentals of functional programming, Real world problems modeling in functional style, Map reduce fundamentals and YARN, Data flow (Architecture), Real world problems, Scalability goal, Fault tolerance, Optimization and data locality, Parallel Efficiency of Map-Reduce

UNIT -IV: NoSQL   **[6 Hrs.]**

Introduction to NoSQL, Structured and Unstructured Data Taxonomy of NoSQL Implementation, Discussion of basic architecture of Hbase, Cassandra and MongoDb

UNIT -V: Searching and Indexing of Big Data   **[7 Hrs.]**

Full text Indexing and Searching, Indexing with Lucene, Distributed Searching with elastic search

UNIT-6: Case Study: Hadoop   **[7 Hrs.]**

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file based data structures

LAB WORKS:

Student will get opportunity to work in big data technologies using various dummy as well as real world problems that will cover all the aspects discussed in course. It will help them gain practical insights in knowing about problems faced and how to tackle them using knowledge of tools learned in course.

Text Book:

1. Jeffrey Dean, Sanjay Ghemawat, MapReduce:Simplified Data Processing on Large Clusters
2. Sanjay Ghemawat, Howard Gobioff, and Shun-Tak Leung, The Google File System

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1. Fay Chang, Jeffrey Dean, Sanjay Ghemawat, Wilson C. Hsieh, Deborah A. Wallach, Mike Burrows, Tushar Chandra, Andrew Fikes, and Robert E. Gruber, Bigtable: A Distributed Storage System for Structured Data