BCA (3 years)

	Amity University Punjab, Mohali							
	Amity School of Engineering and Technology							
	Semester-Wise Programme structure for BCA with Research (Batch-2023) [4 year]							
Sr. No.	**Year 1**		**Year 2**		**Year 3**		**Year 4 (for research students only)**	
	Semester 1	**Semester 2**	**Semester 3**	**Semester 4**	**Semester 5**	**Semester 6**	**Semester 7**	**Semester 8**
1	Basics of Computers and IT (CAS114)[**CU: 5**, L-3, P-2] {CC}	Data Structures (CAS-107) [**CU: 5**, L-3, P-2] {CC}	Computer Networks [**CU:5**, L-4, P-1] {CC}	Operating System [**CU: 5**, L-4, P-1] {CC}	Design and Analysis of Algorithms [**CU: 5**, L-4, P-1] {CC}	E-Commerce [**CU: 4**, L-4] {CC}	Advanced Python Programmimg [**CU: 4**, L-3, P-1] {CC}	Statistics and Data Analysis [**CU: 4**, L-4] {AC}
2	Fundamentals of Mathematics (MAT114) [**CU: 5**, L-5] {AC}	Web Development (Scripting Languages) (CAS-110) [**CU: 4**, L-3, P-1] {SEC}	Database Management System [**CU:5**, L-3, P-2] {CC}	Software Engineering [**CU: 5**, L-4, P-1] {CC}	Foundations of Artificial Intelligence [**CU: 5**, L-4, P-1] {CC}	Ethical Hacking [**CU: 4**, L-4] {CC}	Research Methodology & IPR [**CU: 4**, L-4] {CC}	Risk Analysis and Assessment [**CU: 4**, L-3, P-1] {CC}
3	Problem Solving in C-I (CAS115)[**CU:5**, L-3, P-2] {CC}	Object Oriented Programming System with C++ (CAS-	Programmimg with Python [**CU:5**, L-3, P-2] {CC}	Java Programmimg [**CU: 5**, L-3, P-2] {CC}	Computer Garphics [**CU: 4**, L-3, P-1] {CC}	Machine learning [**CU: 5**, L-4, P-1] {CC}	Soft Computing [**CU: 4**, L-3, P-1] {CC}	Vitualization and Cloud Architecture [**CU: 4**, L-3, P-1] {CC}

#								
		111) [**CU:5**, L-3, P-2] {CC}						
4	PC Assembly & Troubleshooting (CAS-101) [**CU:3,** L-2, P-1] {SEC}	Fundamentals of Mathematical statistics (STA102) [**CU:4**, L-4] {AC}	Computer Architecture [**CU:4**, L-4] {CC}	Domain Elective-I [**CU:5**, L-4, P-1] {DE}	Domain Elective-III [**CU:4**, L-4] {DE}	Domain Elective-IV [**CU:5**, L-4, P-1] {DE}	Secure Communication and Cryptogtraphy [**CU:4**, L-3, P-1] {CC}	Web and Mobile Security [**CU:4**, L-3, P-1] {CC}
5	Understanding Self for Effectiveness (PSY101) [**CU:1**, L-1] {VAC}	Punjabi Langugae & Literature -2 (INL-108)/History & Culture of Punjab for B.Sc.-II (INL-106) [**CU:1**, L-1] {VAC}	Introduction to Entrepreneurship [**CU: 3**, L-3] {HUC}	Domain Elective-II [**CU:4**, L-4] {DE}	Open Elective-II [**CU:3**, L-3] {OE}	Domain Elective-V [**CU:4**, L-4] {DE}	Mathematical Structures in Computer Science (CAS609) [**CU:4**, L-4] {AC}	Research Project -II [**CU:8**] {NTCC}
6	Communication Skills -I (ENG101) [**CU:1,** L-1] {VAC}	Communication Skills -II (ENG103) [**CU:1**, L-1] {VAC}	Open Elective-I [**CU:3**, L-3] {OE}		Industrial Training [**CU:3**] {NTCC}	Major Project [**CU:2**] {NTCC}	Research Project -I [**CU:4**] {NTCC}	

7	Introduction to French Culture & Language (FOL101)/ Introduction to German Culture & Language (FOL102) [**CU:1,** L-1] {VAC}	Individual, Society and Nation (PSY106) [**CU:1,** L-1] {VAC}						
8	Environmental Studies 1 (ENV101) [**CU:2**, L-2] {AEC}	French Grammar (FOL-103)/German Grammar (FOL-104) [**CU:1**, L-1] {VAC}						
9	Punjabi Language and Literature -1(INL-107)/History & Culture of Punjab for B.Sc. (INL-103) [**CU:1**, L-1] {VAC}	Environmental Studies 2 (ENV106) [**CU:2**, L-2] {AEC}						
Credits	**24**	**24**	**25**	**24**	**24**	**24**	**24**	**24**

Total Programme Credits				**193**

AC	**Allied Course**	**SEC**	**Skill Enhancement Course**
AEC	**Ability Enhancement Course**	**VAC**	**Value Added Course**
CC	**Core Course**	**HUC**	**Humanities Course**
GE	**General Elective**	**BSC**	**Basic Science Course**
OE	**Open Elective**	**ESC**	**Engineering Science Course**
SC	**Skill component**	**NTCC**	**Non Teaching Credit Course**
SE	**Specialization Elective Course**		

Proposed Model Framework for BCA (3 Years)

Sr. No.	Category	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-VI	Sem-VII*	Sem-VIII*	Total
1.	Allied Sc.	05	04	00	00	00	00	04	04	**09+08***
2.	Core	10	10	19	15	14	13	16	12	**81+28***
3.	Skill Dev.	03	04	00	00	00	00	00	00	**07**
4.	Domain Ele.	00	00	00	09	04	09	00	00	**22**
5.	Open Ele.	00	00	03	00	03	00	00	00	**06**
6.	VAC (CS)	01	01	00	00	00	00	00	00	**02**
7.	VAC (BS)	01	01	00	00	00	00	00	00	**02**
8.	VAC (FBL)	01	01	00	00	00	00	00	00	**02**
9.	AECC (EVS)	02	02	00	00	00	00	00	00	**04**
10	AECC (IL)	01	01	00	00	00	00	00	00	**02**
11	NTCC	00	00	00	00	03	02	04	08	**05+12***
12	MOOC	00	00	00	00	00	00	00	00	**00**
13	Humanities	00	00	03	00	00	00	00	00	**03**
	TOTAL	**24**	**24**	**25**	**24**	**24**	**24**	**24**	**24**	

- Only for research students

Course: Bachelor's in computer applications (Batch 2023)
Program Structure
Semester I (First year)

Sr. No	Course Code	Course Title	Course Type	Weekly Hours			Credit Units
				L	T	PS	
1		Fundamentals of Mathematics	Allied Course	5	0	0	5
2		Basics of Computers and IT	Core Course	3	0	4	5

				L	T	P/S	Credit
3		Problem Solving in C	Core Course	3	0	4	5
4	CAS-101	PC Assembly & Troubleshooting	Skill component	2	0	2	3
5	PSY-101	Understanding Self for Effectiveness	Value Added Course (Behavioral Science)	1	0	0	1
6	FOL-101/ FOL-102	Introduction to French Culture & Language/ Introduction to German Culture & Language	Value Added Course (Foreign Business Language)	1	0	0	1
7	ENG-101	Communication Skills	Value Added Course (Communication Skills)	1	0	0	1
8	ENV-101	Environmental Studies	Ability Enhancement courses	2	0	0	2
9	INL-101/ INL-102	Punjabi/History & Culture of Punjab	Ability Enhancement courses	1	0	0	1
			TOTAL	**19**	**0**	**10**	**24**
			Total Credits	**Min Required: 24**			
				Semester Credits: 24			

Course Title: Fundamentals of Mathematics

Credit Units: 5
Course Level: BCA
Course Code:

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
5	0	0	0	5

Course Objectives:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. By the end of the semester, students will be able to analyze the concepts of sets, relation, function, differential and integral calculus and matrix algebra, which serve as the foundation for mathematics and statistics, and can be further applied to solve practical problems.

Course Contents/Syllabus:

	Teaching Hours
Module I: Sets, Relations and Functions	**18 H**

Sets and set operations, Proof techniques, Cartesian product of Sets, relations, functions and their types, Graphs, Sequence and series (A.P., G.P.)		
Module II: Limit, Continuity and Differentiability	**19 H**	
Limits. Continuity. Differentiability. Introduction to partial derivatives Increasing and decreasing functions. Maxima and Minima. Rolle's Theorem (without proof). Mean Value Theorem, Indeterminate forms, L-Hopital's Rule. Taylor and Maclaurin series (without proofs)		
Module III: Integral Calculus	**18 H**	
Integral as antiderivative. Integration by various methods. Definite integral and its properties. Areas of bounded regions		
Module IV: Matrix Algebra	**19 H**	
Matrices, their types and operations, Determinants and their properties, solving system of linear equations using Cramer's rule, Matrix Inversion method and Rank method		

Course Learning Outcomes:

At the end of the course, the students will be able to

- Distinguish corresponding sets as representations of relations or functions by the analysis of graphical, numeric, or symbolic data and series representation.
- Introduction to the fundamental concepts of limit, continuity, differentiation, various applications of differential calculus
- Describe connection between integral and differential calculus, integral methods and their applications
- Understand and apply the concept of matrices in real life situations

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir	Thomas' Calculus (14th edition)	Pearson Education	2018	978-9353060411
R.K Jain and S.R.K Iyenger	Advanced Engineering Mathematics	Narosa Publishing House Pvt.,	2016	978-8184875607
N.P.Bali	A textbook of Engineering Mathematics	Laxmi publications	2009	978-8131808320
B.S. Grewal	Engineering Mathematics	Khanna Publishers	2014	978-8193328491
H.K. Dass	Higher Engineering Mathematics	S. Chand	2014	978-8121938907

Course Title: Basics of Computers and IT

	L	T/Practice	P/S	SW/FW	No. of PSDA	TOTAL CREDIT UNITS
Course Contents/Syllabus:	3	0	4	0	0	5

	Total Teaching Hours
Unit I Introduction to computers and Software	13 H
Introduction to computers, characteristics of computer; History of computers; Classification of computers on size: (Micro, Mini, Mainframe and super computers), Working Principles, Generations; Applications of computers; commonly used terms– Hardware, Software, Firmware. Basic Computer Organization: Block diagram of computer system, Input unit, Processing Unit and Output Unit; Description of Computer input devices: Keyboard, Mouse, Trackball, Pen, Touch screens, Scanner, Digital Camera; Output devices: Monitors, Printers, Plotters. Computer Memory: Representation of information: BIT, BYTE, Memory, Memory size; Units of measurement of storage; Main memory: Storage evaluation criteria, main memory organization, RAM, ROM, PROM, EPROM; Secondary storage devices: Sequential Access Memory, Direct Access Memory Magnetic Tapes, Magnetic disks, Optical disks: CD, DVD; Memory storage devices: Flash Drive, Memory card. System and Application software; Programming Languages: Generation of Languages; Translators - Interpreters, Compilers, Assemblers and their comparison	
Unit 2 Operating System and Commands	14 H
Introduction to operating systems and its functions, DOS and versions of DOS, Booting sequence; Warm and Cold Boot; Concepts of files and directories, Wildcard characters, Types of DOS commands: Internal and External Commands. Fundamentals of Windows, Types of Windows, Anatomy of windows, Icons, Recycle bin, Operations on Folders, Registry of Windows: Basics, Editing; Control panel	
Unit 3 Word processing	13 H
Opening, saving and closing an existing document; renaming and deleting files;, Working with text: select, cut, copy, paste, find and replace, inserting special characters, setting tab stops and indents, Checking spelling and Grammar, Autocorrect, Using built-in language tools, word completion, Autotext, Formatting text: formatting paragraphs, formatting characters, auto- formatting, creating lists; Formatting pages: Using layout methods, creating headers and footers, Numbering pages, Changing page margins, Adding comments to a document, Creating a table of contents, Creating indexes and bibliographies, Printing a document, Using mail merge, Tracking changes to a document.	
Unit 4 Spreadsheet processing and MS Power Point	14 H
Introduction to Spreadsheets, sheets and cells; Opening and saving spreadsheet files; Working with sheets: inserting new sheet, deleting and renaming sheets, Viewing a spreadsheet: freezing rows and columns, splitting screen, Entering data: cell referencing, formatting cells, entering numbers, entering numbers as text, entering formulae, entering date and time, Validating cell contents, Formatting data: formatting text, numbers, cells, Auto formatting cells and sheets, defining new auto format, Using conditional formatting, Sorting records, Printing a spreadsheet document: using print ranges, page formats, inserting page breaks, headers and footers; Working with Graphs and Charts : Creating Embedded Chart, formatting chart: Changing chart types, adding Titles, Legends and Gridlines, Printing Charts;	

Creating Macros, Recording Macros, Running Macros, Microsoft Power Point, Creating Presentations, Layouts, Design and Transition Options, Animation Options, Various Views of Presentations, Types of timers, Using Slide Master etc.	

Lab/ Practical details, if applicable: (Total: 60 Hours)

Objective: The laboratory exercises in this section have been so designed that the students can perform hands-on on various application based softwares including MS word. Ms Excel. Power point

1. Perform Installation of Windows OS
2. Perform Installation of MS office
3. Perform various DOS commands
4. Perform various exercises on MS word covering various Menu bars and command groups
5. Perform various exercises on MS Excel covering various Menu bars and command groups
6. Perform various exercises on MS power point covering various Menu bars and command groups

Faculty member can decide various experiments related to MS office applications. Minimum 15 experiments must be completed

Course Learning Outcomes: This course will enable the students to
1. Understanding the concept of input and output devices of Computers
2. Learn the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.
3. Understand an operating system and its working, and solve common problems related to operating systems
4. Learn basic word processing, Spreadsheet and Presentation Graphics Software skills

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
A. Goel	Computer Fundamentals	Pearson	2010	978-8131733097
P. K.Sinha & P. Sinha	Fundamentals of Computers	BPB Publisher	2007	978-8176567527
Peter Norton	Introduction to Computers	McGraw Hill Education	2017	978-0070671201

Course Title: Problem Solving in C

	L	T	P/S	SW/FW	No. of PSDA	TOTAL CREDIT UNITS
Course Contents/syllabus:	3	0	4	0	0	5

	Total Teaching Hours
Unit I: Introduction to computer and programming	**12 H**
Introduction, Basic block diagram and functions of various components of computer, Concepts of Hardware and software, Types of software, Compiler	

and interpreter, Concepts of Machine level, Assembly level and high level programming, Flowcharts and Algorithms	
Unit II: Fundamentals & Structure of C	**18 H**
Features of C language, structure of C Program, comments, header files, data types, constants and variables, operators, expressions, evaluation of expressions, type conversion, precedence and associativity, I/O functions	
Unit III: Array, String & Functions	**15 H**
Concepts of array, one and two dimensional arrays, declaration and initialization of arrays, string, string storage, Built-instring functions, Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, Macros, Pre-processing	
Unit IV: Pointers	**15 H**
Basics of pointers, pointer to pointer, pointer and array, pointer to array, array to pointer, function returning pointer. Basics of structure, structure members, accessing structure members, nested structures, array of structures, structure and functions, structures and pointers	

Lab/ Practical details, if applicable: **(Total: 60 Hours)**

Objective: The laboratory exercises in this section have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out hands on experience in programming

1. Write a program to that performs as calculator (addition, multiplication, division, subtraction).
2. Write a program to find area of triangle(a=h*b*.5) a = area h = height b = base
3. Write a program to calculate simple interest (i = (p*r*n)/100)i = Simple interest p = Principal amount r = Rate of interest n = Number of years
4. Write a C program to interchange two numbers.
5. Write a C program to enter a distance in to kilometer and convert it in to meter, feet, inches and centimeter
6. Write a program to compute Fahrenheit from centigrade (f=1.8*c +32)
7. Write a C program to find out distance travelled by the equation $d = ut + at^2$
8. Write a C program to find that the accepted number is Negative or Positive or Zero.
9. Write a program to read marks of a student from keyboard whether the student is pass or fail(using if else)
10. Write a program to read three numbers from keyboard and find out maximum out of these three. (nested if else)
11. Write a C program to check whether the entered character is capital, small letter, digit or any special character.
12. Write a C program to read no 1 to 7 and print relatively day Sunday to Saturday.
13. Write a C program to find out the Maximum and Minimum number from given 10 numbers
14. Write a C program to input an integer number and check the last digit of number is even or odd.
15. Write a C program to find factorial of a given number.
16. Write a program to reverse a number.
17. Write a program to generate first n number of Fibonacci series
18. Write a program to find out sum of first and last digit of a given number.
19. Write a C program to find the sum and average of different numbers which are accepted by user as many as user wants
20. Write a program to calculate average and total of 5 students for 3 subjects (use nested for loops)
21. Read five persons height and weight and count the number of person having height greater than 170 and weight less than 50, 24. Write a program to check whether the given number is a prime or not.
22. Write a program to evaluate the series $1^2+2^2+3^2+\ldots\ldots+n^2$

23. Write a C program to find 1+1/2+1/3+1/4+....+1/n.
24. Write a C program to find 1+1/2! +1/3! +1/4! +.....+1/n!
25. Write a program to evaluate the series sum=1-x+x^2/2!-x^3/3!+x^4/4!......-x^9/9!

Course Learning Outcomes:
1. Formulate algorithm/flowchart for given arithmetic and logical problem
2. Translate algorithm/flowchart into C program using correct syntax and execute it
3. Write programs using conditional, branching, iteration, and recursion
4. Decompose a problem into function
5. Develop an application using the concepts of array, pointer, structure, and file management to solve engineering and/or scientific problems

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Pradip Dey, Manas Ghosh	Fundamentals of Computing and Programming in C	Oxford University Press	2009	978-0198084563
Gottfried	Programming with C	Tata McGraw-Hill Publishing Company Limited	2nd edition, 2005	978-0070593695
Kernighan B W and Ritchie D M	C Programming language, Second edition	Prentice Hall	2nd edition , 1988	978-0131103627
R.G. Dromey	How to Solve it by Computer	Pearson Education	Fourth Reprint, 2007	978-8131705629

Course Title: PC Assembly and Troubleshooting

L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
2	0	2	0	3

Course Contents/syllabus:

	Total Teaching Hours
Unit I: Introduction	**8 H**
Brief history of computer on the basis Hardware. Computer system modules components and its operations, need of hardware and software for computer to work, different hardware components within a computer and connected to a computer as peripheral devices, different processors used for personal computers and notebook computers.	

Unit II: Installations	7 H
Perform installation, configuration, and upgrading of microcomputer/computer: Hardware and software requirement, Assemble/setup microcomputer/ computer systems, accessory boards, types of motherboards, selection of right motherboard, Installation replacement of motherboard, troubleshooting problems with memory	
Unit III: Peripheral Devices	8 H
Install/connect associated peripherals: Working of printers and scanners, Installation of printers and scanners, sharing a printer over a local area network, troubleshooting printer and scanner problems, troubleshooting hard drive problems. Drivers: Meaning, role and types	
Unit IV: IT troubleshooting	7 H
Diagnose and troubleshooting of microcomputer/ computer systems hardware & software and other peripheral equipment: Approaches to solve a PC problem, troubleshooting a failed boot before the OS is loaded, different approaches to installing and supporting I/O device, managing faulty components. Booting and its types.	

Lab/ Practical details, if applicable: **(Total: 30 Hours)**

Objective: The objective of this laboratory is to give basic understanding about computer components, assembly and troubleshooting daily problems related to computers.

1. Various tasks related to computer assembly and disassembly to be performed.
2. Various exercises related to printer/scanner installation to be performed including network sharing.
3. Various tasks related to motherboard and memory troubleshooting to be performed.
4. Various tasks related to booting and BIOS settings to be performed.
5. Various tasks related to installation and configuring various servers to be performed.

Course Learning Outcomes: At the end of this course, the students will be able to understand the various important software and hardware aspects of a computer system

1. Understand the basic structure of a computer.

2. Assembling, configuring computer systems and connecting the peripheral devices.

3. Installation of various softwares.

4. Diagnose and resolving the issues related to Computer Systems

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Craig Zacker and John Rourke	PC Hardware: The Complete Reference	McGraw-Hills	1st edition, 2017	978-0070436060
Hans-Peter Messmer	The Indispensable PC Hardware Book	Addison Wesley	4th edition, 2001	978-0201596168

Ron Gilster	C Hardware: A Beginner's Guide	McGraw-Hills	2001	978-0072129908

COURSE CODE: PSY101 (Understanding Self for Effectiveness)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus:

	Total Teaching Hours
Unit I: Self: Core Competency	**4.5 h**
Understanding of Self, Components of Self – Self identity , Self concept, Self confidence , Self image , BIG5 Factors	
Unit II: Techniques of Self Awareness	**4.5 h**
Exploration through Johari Window, Mapping the key characteristics of self, Framing a charter for self Stages – self awareness, self acceptance and self realization	
Unit III: Self Esteem & Effectiveness	**4.5 h**
Meaning, Importance, Components of self esteem, High and low self esteem, Measuring your self esteem	
Unit IV: Building Positive Attitude and Emotional Competence	**4.5 h**
Meaning and nature of attitude, Components and Types of attitude ,Importance and relevance of attitude Emotional Intelligence – Meaning, components, Importance and Relevance Positive and negative emotions, Healthy and Unhealthy expression of emotions	

Course Learning Outcomes: At the end of this course, the students will be able to:
1. The student will apply self-introspection as a tool for self-awareness.
2. The student will understand self-concept for self-recognition, self-improvement and perception of others.
3. The student will be able to analyze their physical self, social self, the competent self and psychological self.
4. The student will be able to analyze what motivates his/her actions and the actions of others

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Singh A.	Achieving Behavioural Excellence for Success	Wiley Publication	2012	97881265 8027
Towers, Marc	Self Esteem	American Media	1995	97818849 26297
Pedler Mike, Burgoyne John, Boydell Tom	A Manager's Guide to Self-Development	McGraw-Hill	2006	978-00771147 01
Covey, R. Stephen	Seven habits of Highly Effective People	Simon & Schuster Ltd	2013	978-14516396 12

Khera Shiv	You Can Win	Macmillan	2005	978-0333937402
Gegax Tom	Winning in the Game of Life	Harmony Books	1999	978-0609603925
Singh, Dalip	Emotional Intelligence at Work	Publications	2006	9780761935322
Goleman, Daniel	Emotional Intelligence	Bantam Books	2007	9780553095036
Goleman, Daniel	Working with E.I	Bantam Books	1998	9780553104622

COURSE CODE: FOL101 (Introduction to French Culture & Language)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus:

	Total Teaching hours
Unit-I Introduction to French language	**3 h**
• Brief introduction of French and Francophone countries • Presenting oneself • Getting information about someone else • Greeting and taking leave • Asking/giving personal information	
Unit-II- A rendez-vous ; Visiting a place	**6 h**
• Pronouncing and writing numbers in French • Spell and count numbers • Telling the time • Temporal expressions • Communicating in class • Fixing an hour, place for a meeting. • Describing a person. • Identifying a person, object and place • Describing relation in a family • A specific person, object and place	
Unit-III- An interview	**4.5 h**
• Description of objects, people and places • Nationalities • Speaking about one's professions • Expressing Actions using regular –er ending verbs; avoir, être; reflexive verbs – usage, conjuagation • Interview of celebrity	
Unit-IV- At the discotheque	**4.5 h**

• Portrait by a journalist	
• Giving a positive or negative reply	
• Asking questions	
• Discussion with a person	
• Activities in a day	

Course Learning Outcomes: At the end of this course, the students will be able to express themselves in writing and orally in basic French. This course content focuses on the speech of the students in a lucid and a concurrent manner using appropriate vocabulary and pronunciation techniques. Extra stress will be given on their understanding of grammatical structures and the foreign accent of the language. At the end of the course, the student shall be able to :

1. Understand information; Express in his own words; Paraphrase; Interpret and translate.
2. Apply information in a new way in a practical context
3. Analyse and break-down information to create new ideas
4. Evaluate and express opinion in a given context

Text / Reference Books:

Author	Title	Publisher	Year	ISBN No
Christine Andant, Chaterine Metton, Annabelle Nachon, Fabienne Nugue	A Propos - A1 Livre De L'Eleve, Cahier D' Exercices	Langers International Private Limited	2010	978-9380809069
Manjiri Khandekar and Roopa Luktuke	Jumelage - 1 Methode De Fraincais - French	Langers International Private Limited	2020	978-9380809854
Michael Magne, Marie-Laure Lions-Olivieri	Version Originale 1: Cahier d'exercices	Maison Des Langues	2010	978-8484435617

COURSE CODE: FOL102 (Introduction to German Culture & Language)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus:

	Total Teaching hours
Unit-I Introduction to German Language (Einführung)	**3 h**
• Introduction to German as a global language, Self-introduction and Greetings, Die Alphabeten, Phonetics: the sound of consonants and vowels, Wie buchstabieren Sie Ihren Name?	
Unit-II- Numbers and everyday conversation (die Zahl und Gespräche)	**6 h**
• Counting in German from 1-100, Simple Calculation and verb 'kosten' - Wie viel kostet das? Plural Forms, Vocabulary: Wochentage, Monate, Jahreszeiten, Ordinal numbers and the question - Wann haben Sie Geburtstag?	
Unit-III- Regular verbs and nominative case: articles and pronouns (Regelmässige Verben und Nominativ Kasus: Artikel und Pronomen)	**4.5 h**
• Introduction to all personal pronouns and conjugation of Regular verbs	

Detailed exercise on regular verbs. Reading a text on regular verbs. Introduction to definite. Vocabulary: Schulsachen und Getränke, Nominative case/ Articles (der, die, das) Nominative Pronouns: - Applicability of pronouns for both persons and things. Usage of nominative Personal Pronouns Introduction of nominative possessive pronouns usage of nominative possessive pronouns	
Unit-IV- The Family, Work-life and Professions (Familienmitglieder und Berufe) & Interrogative sentences (W-Fragen)	**4.5 h**
The Family, Work-life and Professions (Familienmitglieder und Berufe) • Vocabulary: Professions and conjugation of the verb 'sein' Introduction to simple possessive pronouns with the help of the verb 'haben' Usage of possessive pronouns. Interrogative sentences (W-Fragen) W-Fragen: who, what, where, when, which, how, how many, how much, etc. Exercises on the question pronouns	

Course Learning Outcomes: At the end of this course, the students will be able to express themselves in writing and orally in basic German. This course content focuses on the speech of the students in a lucid and a concurrent manner using appropriate vocabulary and pronunciation techniques. Extra stress will be given on their understanding of grammatical structures and the foreign accent of the language. At the end of the course, the student shall be able to:

1. Understand information; Express in his own words; Paraphrase; Interpret and translate.
2. Apply information in a new way in a practical context
3. Analyse and break-down information to create new ideas
4. Evaluate and express opinion in a given context

Text / Reference Books:

Author	Title	Publisher	Year	ISBN
Rolf Bruseke	Starten Wir A 1	Langers International Pvt Ltd (Max Hueber Verlag)	2017	978-3190160006
Giorgio Motta	Wir Plus Grundkurs Deutsch fur Junge Lerner Book	Ernst Klelt Verlog	2011	978-8183072120
Heimy Taylor, Werner Haas	Station en Deutsch Self Study Course German Guide	Wiley	2007	978-0470165515

COURSE CODE: ENG101 (Communication Skills-I)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus:

	Total Teaching hours
Unit I: Basic Concepts in Communication	3.5 h
Definition of communication, Nature and process of communication, role and purpose of communication, types and channels of communication, communication networks/flow of communication: vertical, diagonal, horizontal, barriers to communication: physical, language, and semantic, socio-psychological, organizational, gateway to effective communication, towards communicative competence, choosing the appropriate channel and medium of communication, social communication: small talk and building rapport, barriers in communication.	
Unit II: Communication Types	5.5 h
Verbal communication: Oral Communication: Forms, Advantages & Disadvantages, Written Communication: Forms, Advantages & Disadvantages, Introduction of Communication Skills (Listening, Speaking, Reading, Writing), Nonverbal communication: functions and effective use, KOPPACT(Kinesics, Oculesics, Proxemics, Para-language, Artifacts, Chronemics, Tactilics). The implication of appropriate communication; effective ways of using social media, importance of digital literacy.	
Unit III: Reading and Writing Skills	3 h
Significance of reading; Reading Comprehension, gathering ideas from a given text, identify the main purpose and context of the text, evaluating the ideas, interpretation of the text, Paragraph development; essay writing.	
Unit IV: Speaking and Presentation Skills	6 h
Speaking skills: fluency, vocabulary, grammar, and pronunciation; effective speaking: selection of words, your voice, and non-verbal communication, functions of speaking: interaction, transaction, and performance; structuring the message; effective speaking strategies. Planning, preparation, practice, and performance; audience analysis, audio-visual aids, analyzing the non-verbal communication, methods of delivery: impromptu, extemporaneous, memorization, manuscript, and outlining.	

Course Learning Outcomes:
1. Students will be able to understand the basic processes of communication, both verbal as well as non-verbal—nature, scope, and power of communication processes.
2. Students will be able to demonstrate cultural sensitivity in communication and appreciation of cultural variations of diverse socio-cultural contexts.
3. Students will be able to develop an awareness of the role of mass media in shaping public psyche, beliefs, and perceptions about social realities and build an informed and critical perspective.
4. Students will be able to analyze situations and audiences to make right choices about the most effective and efficient ways to communicate and deliver messages.
5. Students will be able to assess various barriers in communication and develop communicative competence thereby for effective communication.

Books/literature

AUTHOR	TITLE	Publisher	Year of publication	ISBN
P. D. Chaturvedi and Mukesh Chaturvedi	Business Communication: Concepts, Cases and Applications	Pearson Education	2006	9788131 701720

Meenakshi Raman and Prakash Singh	Business Communication	Oxford University Press	2012	9780198 077053
Jeff Butterfield	Soft Skills for Everyone	Cengage Learning	2017	9789353 501051

COURSE CODE: FOL101 (Environmental Studies-I)

L	T	P	Total Credits
2	0	0	2

Course Contents/syllabus:

	Teaching hours
Unit-1- Multidisciplinary nature of environmental studies	**9 h**
Multidisciplinary nature of environmental studies: Definition, scope and importance; components of environment –atmosphere, hydrosphere, lithosphere and biosphere. Concept of sustainability and sustainable development.	
Unit-2-Ecosystems	**9 h**
Ecosystem: What is an ecosystem; Structure and function of an ecosystem; Energy flow in the ecosystem; Food chains, food webs and ecological succession. Case studies of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).	
Unit-3- Natural Resources	**9 h**
Natural resources: Land resources and land use change, land degradation, soil erosion and desertification. Deforestation: causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal population. Water Resources-Use and over-exploitation of surface and groundwater, floods, drought, conflicts over water (international and inter-state). Heating of earth and circulation of air; air mass formation and precipitation. Energy resources- renewable and non-renewable energy sources, use of alternate energy sources, Growing energy needs, Case studies.	
Unit-4- Biodiversity and its conservation	**9 h**
Biodiversity: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; biodiversity patterns and global biodiversity hot spots. India as a mega–biodiversity nation; endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; conservation of biodiversity: in-situ and ex-situ conservation of biodiversity. Ecosystem and biodiversity services: ecological, economic, social, ethical, aesthetic and information value.	

Course Learning Outcomes: At the end of this course, the students will be able to develop:
1. Appreciate the multi-disciplinary nature of environmental science
2. Understand natural resources and evaluate limitations surrounding renewable and non-renewable resources
3. Understand the nuances of ecosystem and learn about behaviour of various ecosystem
4. Learn about the types, services and threats to our biodiversity and importance of conserving it.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

William P. Cunningham, Mary Ann Cunningham	Principles of Environmental Science	McGraw-Hill	2019	9781260 219715
Dash and Dash	Fundamentals of ecology	Tata McGraw-Hill Education	2009	978-0070083 660
William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo	Environmental Science: A global concern,	McGraw-Hill	2021	9781260 363821
Gaston K.J. and Spicer, J. I.	Biodiversity – An Introduction 2nd edition	Blackwell Publishing	2004	978-1-405-11857-6

COURSE CODE: FOL101 (Punjabi)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus:

	Teaching hours
Unit I:	4.5 h
ਆਧੁਨਿਕਪੰਜਾਬੀਕਵਿਤਾਦਾਅਧਿਐਨ	
Unit II:	4.5 h
ਲੇਖਰਚਨਾ	
Unit III:	4.5 h
ਸੰਖੇਪਰਚਨਾ	
Unit IV:	4.5 h
ਵਿਆਕਰਨ :ਸਿੱਧਾਂਤਤੇਵਿਹਾਰ	

Course Learning Outcomes:

1. Understand modern Punjabi poetry.
2. Interpret the importance of essay writing
3. Analyze the essentials of composition writing.
4. Examine the impact and importance of grammar on Punjabi language.

Text / Reference Books:

ਸਹਾਇਕ ਪੁਸਤਕਾਂ :
1. ਪੰਜਾਬੀ ਸੰਚਾਰ ਯੋਗਤਾ ਅਭਿਆਸ, ਪੰਜਾਬ ਸਟੇਟ ਯੂਨੀਵਰਸਿਟੀ ਟੈਕਸਟ ਬੁੱਕ ਬੋਰਡ, ਚੰਡੀਗੜ੍ਹ।
2. ਅਰਗਨੀਹੋਤਰੀ, ਵੇਦ, ਪਰਿਚਾਇਕ ਭਾਸ਼ਾ ਵਿਗਿਆਨ, ਦੀਪਕ ਪਬਲਿਸ਼ਰਜ, ਜਲੰਧਰ. 1981.
3. ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ ਅਤੇ ਹੋਰ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਗਿਆਨ, ਭਾਗ-ਪਹਿਲਾ, ਦੂਜਾ ਤੇ ਤੀਜਾ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ. 1997.
4. ਹਰਕੀਰਤ ਸਿੰਘ (ਡਾ.), ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਨ , ਪੰਜਾਬ ਸਟੇਟ ਯੂਨੀਵਰਸਿਟੀ ਟੈਕਸਟ ਬੁੱਕ ਬੋਰਡ, ਚੰਡੀਗੜ੍ਹ. 1999
5. ਧਾਲੀਵਾਲ, ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ ਸਿੰਘ (ਡਾ.) ਸਿਧਾਂਤਕ ਭਾਸ਼ਾ ਵਿਗਿਆਨ , ਮਦਾਨ ਪਬਲਿਕੇਸ਼ਨਜ, ਪਟਿਆਲਾ. 2002.
6. ਬਰਾੜ, ਬੂਟਾ ਸਿੰਘ (ਡਾ.). ਪੰਜਾਬੀ ਵਿਆਕਰਨ, ਸਿਧਾਂਤ ਅਤੇ ਵਿਹਾਰ , ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ ਲੁਧਿਆਣਾ, 2008.
7. ਜੱਸਲ ਕਵਲਜੀਤ, ਪੰਜਾਬੀ ਵਿਆਕਰਨ ਦੇ ਕੁਝ ਪੱਖ , ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਹਾਲ ਬਾਜ਼ਾਰ, ਅੰਮ੍ਰਿਤਸਰ. 2012.
8. ਮਨਜੀਤ ਕੌਰ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਵਰਤੋ ਤੇ ਬਣਤਰ, ਲੋਕਗੀਤ ਪ੍ਰਕਾਸ਼ਨ, ਚੰਡੀਗੜ੍ਹ।
ਨੋਟ: 1. ਟੈਕਸਟ ਲਈ ਹਫ਼ਤੇ ਦੇ ਛੇ ਪੀਰੀਅਡ।
2. ਕੰਪੋਜੀਸ਼ਨ ਲਈ 25-30 ਵਿਦਿਆਰਥੀਆਂ ਦਾ ਗਰੁੱਪ ਅਤੇ ਹਫ਼ਤੇ ਦੇ ਤਿੰਨ ਹੋਰ ਪੀਰੀਅਡ।
3. ਹਫ਼ਤੇ ਦੇ 6+3= 9 ਪੀਰੀਅਡ ।

COURSE CODE: FOL102 (History and Culture of Punjab)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus

	Teaching hours
Unit I:	**4.5 h**
1. Harappan Civilization: extent and town planning and socio-economic life. 2. Life in Vedic Age: socio-economic and religious; 3. Growth and impact of Jainism and Buddhism in Panjab.	
Unit II:	**4.5 h**
4. Society and Culture under Maurayas and Guptas. 5. Bhakti movement: Main features; prominent saints and their contribution. 6. Origin and development of Sufism	
Unit III:	**4.5 h**
7. Evolution of Sikhism: teaching of Guru Nanak; Institutional Development- Manji, Masand, Sangat and Pangat 8. Transformation of Sikhism: Martyrdom of Guru Arjan; New policy of Guru Hargobind, martyrdom of Guru Tegh Bahadur. 9. Institution of Khalsa: New baptism; significance	
Unit IV:	**4.5 h**
10. Changes in Society in 18th century: social unrest; emergence of misls and other institutions - rakhi, gurmata, dal khalsa. 11. Society and Culture under Maharaja Ranjit Singh. 12. MAP (of undivided physical geographical map of Punjab): Major Historical Places: Harappa, Mohenjodaro, Sanghol, Ropar, Lahore, Amritsar, Kiratpur, Anandpur Sahib, Tarn Taran, Machhiwara, Goindwal, Khadur Sahib.	

Course Learning Outcomes:

1. Understand the history of various cultures in Punjab.
2. Interpret the importance of Maurayan,Gupta   and Bhakti influences on Punjab
3. Apply the teaching of Sikhism on the emergence of the Khalsa .
4. Examine the impact societal changes on socio-cultural and physical landscape of Punjab

Text / Reference Books:

Author	Title	Publisher	Ed/year	ISBN No
L.M Joshi,	History and Culture of the Punjab, Part-I	Punjabi University, Patiala	1989,3rd	-
Buddha Prakash	Glimpses of Ancient Punjab	Punjabi University, Patiala,	1983	-
Khushwant Singh	A History of the Sikhs, vol I: 1469-1839, .	oxford University Press, Delhi	1991	-

Course: Bachelors in Computer Applications

Program Structure
Semester II (First year)

Sr. No	Course Code	Course Title	Course Type	Weekly Hours			Credit Units
				L	T	PS	
1		Fundamentals of Mathematical statistics	Allied Course	4	0	0	4
2	CAS-111	Object Oriented Programming system with C++	Core Course	3	0	4	5
3	CAS-107	Data Structures	Core Course	3	0	4	5
4	CAS-110	Web Development (Scripting Languages)	Skill component	3	0	2	4
5	PSY-106	Individual, Society and Nation	Value Added Course (Behavioral Science)	1	0	0	1
6	FOL-103/FOL-104	French Grammar/German Grammar	Value Added Course (Foreign Business Language)	1	0	0	1
7	ENG-103	Communication Skills	Value Added Course (Communication Skills)	1	0	0	1
8	ENV-106	Environmental Studies 2	Ability Enhancement courses	2	0	0	2
9	INL-104/INL-106	Punjabi Language & Literature)/History & Culture of Punjab for B.Sc.-II	Ability Enhancement courses	1	0	0	1
			TOTAL	**19**	**0**	**10**	**24**
			Total Credits	**Min Required: 24**			
				Semester Credits: 24			

Course Title: Fundamentals of Mathematical Statistics

	L	T	P	TOTAL CREDIT UNITS
	4	0	0	4

Course Contents/syllabus:	Teaching Hours
Unit I	**15 H**
Data collection and graphical presentation, Descriptive Statistics: Measures of central tendency-Mean, Median, Mode, weighted mean. Measures of dispersion: variance, standard deviation, and range, skewness and kurtosis.	
Unit II	**15 H**
Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability and Independence, Bayes' theorem, and its applications. Random variables: discrete and continuous, density and mass functions. Expected values and moment generating functions.	
Unit III	**15 H**
Discrete distributions: Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric, and their properties. Continuous distributions: Uniform, Exponential, Gamma, Beta, Weibull, Normal and Lognormal, and their properties.	
Unit IV	**15 H**
Transformation of random variable and Probability integral transformation. Multiple random variable, Joint and Marginal distributions, Bivariate transformation, Covariance and correlation.	

Course Learning Outcomes: On the successful completion of this course the student will be able to understand the
1. Basics of descriptive statistics
2. Basics of the probability and random variable
3. Statistical distributions and their applications in the real-world problems
4. Multiple random variable and transformation of random variable

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Rohatgi V. K. and Saleh, A.K. Md. E.	An Introduction to Probability and Statistics	2nd Edition, John Wiley and Sons	2009	9788126519262, 9788126519262
Casella G. and Berger R. L.	Statistical Inference	2nd Edition, Cengage Learning India	2002	9788131503942, 9788131503942

Hogg R. V., Mckean J. and Craig A. T	Introduction to Mathematical Statistics	7th Edition, Pearson Education India	2013	9789332519114, 9789332519114
Mukhopadhyay P	Mathematical Statistics	Books and Allied	2016	9788187134930

Course Title: Data Structures

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
Course Contents/syllabus:					
	3	0	4	0	5

	Teaching Hours
Unit I: Linear Data Structures	**12 H**
Introduction to data structures, Arrays and operations, Stack and its operations- push, pop. Queue and operations: enqueue, dequeue. Applications. Implementation of recursive procedures by stack. Infix to postfix conversions, Evaluation of postfix expression.	
Unit II: Searching and sorting	**11 H**
Searching - sequential searching, binary searching, Sorting techniques: bubble sort, selection sort, insertion sort, quick sort, merge sort.	
Unit III: Linked Lists	**11 H**
Linked lists, doubly linked list, Circular linked list, operations on linked lists: create, insert, display, delete, traverse.	
Unit IV: Trees and Graphs	**11 H**
Tree terminologies, Binary tree, Tree Transversals (pre-order, post-order and in-order), Operations: Search, Insert, Delete. Binary search tree. Graph terminology, Sequential representation: Adjacency matrix, traversing a Graphs, Breadth first search, Depth first search	

Lab/ Practical details:

List of Experiments -with basic instructions   (Total: 60 Hours)

1. To implement insert, delete, create and other operations on arrays.

2. To implement push and pop on stacks.

3. To implement enqueue and dequeue in queues.

4. To implement different operations related to linear and circular queues

5. To implement TOH and Fibonacci Series using Recursion

6. To implement sorting techniques: bubble, insertion, selection, quick, merge sort.

7. To implement operations related to linked list: singly and doubly.

8. WAP to create a binary tree.

9. WAP for in order, preorder and post order traversal in binary tree.

10. Implementation of creation of graphs.

11. Implementation of Graphs: Graph traversals.

Course Learning Outcomes:

1. The student is expected to get familiar about the concept of data organization in memory and data structures.

2. To understand and apply linear data structures like arrays, stacks, queues along with their applications.

3. To implement various searching and sorting techniques.

4. To understand and apply concept of linked structures in the form of linked lists and its types.

5. To understand and apply nonlinear data structures like trees and graphs.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Seymour Lipschutz	Data Structures With C - by Schaum series	Tata McGraw Hill	2017	978-0070701984
Robert Kruse, C.L. Tondo, Bruce Leung Pearson.	Data structures and Program Design in C	Pearson India	2006	8177584235
Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum	Data Structure Using C & C++, Tannenbaum, PHI	Pearson	2006	8131703282

			2017	0074624717
Tremblay & Sorenson	An Introduction to Data Structures with Application	McGraw Hill Education		

Course Title: Object Oriented Programming using C ++

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	0	4	0	5

Course Contents/syllabus:

	Teaching Hours
Unit I: Objects and classes	**12 H**
Introduction to OOP, C vs C++, Encapsulation and aabstraction, Class definition, Class structure, Objects, Passing and returning objects as arguments, Static data member, array of objects, member functions, Inline functions.	
Unit II: Constructors, Destructors and Overloading	**11 H**
Constructors, Destructors, Dynamic creation and destruction of objects Array of objects, this pointer, Friend function, Operator overloading: Unary, Binary operators.	
Unit III: Inheritance	**11 H**
Inheritance, Base class and derived class, Public, private and protected inheritance, Single, Multiple, Multilevel, Hybrid inheritance.	
Unit IV: Polymorphism, Exceptions	**11 H**
Polymorphism, Compile Time and run Time, static and dynamic binding, virtual functions, pure virtual functions, Exception handling	

Lab/ Practical details:

List of Experiments -with basic instructions   (Total: 60 Hours)

Objective: The aim of this section of Lab is to teach experiments of object-oriented programming using C++ pertaining to the units being taught in the theory paper specifically related to classes, objects, inheritance and overloading.

1. WAP in C++ to find the sum of individual digits of a positive integer.

2. WAP in C++ to generate the first n terms of the sequence

3. WAP to find both the largest and smallest number in a list of integers.

4. WAP to illustrate New and Delete Keywords for dynamic memory allocation

5. WAP Illustrating Class Declarations, Definition, and Accessing Class Members.

6. WAP to illustrate default constructor, parameterized constructor and copy constructors

7. WAP to Implement a Class STUDENT with appropriate member functions and variables.

8. WAP to demonstrate the i) Operator Overloading. ii) Function Overloading.

9. WAP to demonstrate Friend Function

10. WAP to access Members of a STUDENT Class Using Pointer to Object Members.

11. Write C++ programs that illustrate how the following forms of inheritance are supported: a) Single inheritance b) Multiple inheritance c) Multi level inheritance

12. WAP containing a Possible Exception. Use a Try Block to Throw it and a Catch Block to Handle it Properly.

Course Learning Outcomes:

1. The student is expected to get familiar about concepts of object-oriented programming.

2. To understand the use of classes and objects and implement the design of object-oriented programs.

3. To familiarize with constructors, destructors and their types.

4. To demonstrate operator overloading, inheritance and their various forms.

5. To use polymorphism in object-oriented scenarios and exception handling

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
E Balagurusamy	Object Oriented Programming with C++ (2017) 7th ed.	McGraw Hill Education	2017	9352607996
Schildt H.	C++: The Complete Reference,	Tata McGraw Hill	2003	007053246X
Robert Lafore	Object Oriented Programming in Turbo C++	Galgotia Publications	1991	8185623228
Walter Savitch	Problem solving with C++: The Object of Programming	Pearson Education.	2002	0321136640

Course Title: Web Development (Scripting Languages)

L	T	P/S	SW/FW	Total Credit Units
3	0	2	0	4

Course Contents/syllabus:

	Teaching Hours
Unit I: HTML and XHTML	**12 H**
Introduction to world wide web, web pages, web applications. HTML and XHTML, document structure, Images, Hypertexts, Tables, Forms, Frames, tags, attributes, List types.	
Unit II: CSS	**11 H**
CSS: Introduction, Levels of style sheets, Style specification formats, Selector and Property value forms, Font, List properties, Alignment, colour of text, The Box model, Background images, Conflict resolution.	
Unit III: Basics of Javascript	**11 H**
JavaScript: Object orientation, Variables, Operators, expressions; Screen output and keyboard input; Control statements; Objects Arrays; Functions, Regular expressions.	
Unit IV: Java Script and HTML	**11 H**
Java Script and HTML Documents, Dynamic Documents with JavaScript, Object Model; Element access, event handlers.	

Lab/ Practical details:

List of Experiments -with basic instructions   (Total: 30 Hours)

Objective: The aim of this section of Lab is to teach experiments of web development pertaining to the units being taught in the theory paper specifically related to HTML, CSS and JavaScript.

1. To implement various HTML tags of document, hypertext,

2. To create web pages with HTML tables and formatting

3. To create web pages with forms, frames and list tags in HTML.

4. To add CSS sheets with formatting like alignment, color etc.

5. To implement various javascript controls like if -else, arrays etc.

6. To implement various javascript controls with conditional statements

7. To integrate javascript with HTML with basic settings.

8. To embed javascript in HTML pages with event handlers.

9. To create forms using javascript and HTML and get data from user.

10. To create multiple forms using javascript and HTML and implement various formatting options.

Course Learning Outcomes:

1. The student is expected to get familiar about the concept of web development and able to design web pages using scripting languages.

2. To understand the concepts of HTML, CSS and javascript.

3. To learn to use various tags, links and formatting used in HTML.

4. To learn and understand various styling formats in HTML documents.

5. To know how to integrate javascript with HTML pages and implement various events on web forms.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Thomas Powell	Web Design The complete Reference	Tata McGrawHill	2002	978-0072224429
Thomas Powell	HTML and XHTML The complete Reference	Tata McGrawHill	2003	9780072229424
Thomas Powell and Fritz Schneider	JavaScript 2.0 : The Complete Reference	Tata McGrawHill	2012	9780071741200
Steven M. Schafer	HTML, CSS, JavaScript, Perl, Python and PHP - Web standards Programmer's Reference	Wiley Publishing, Inc..	2007	978-0764588204

Course Title: INDIVIDUAL, SOCIETY AND NATION

	L	T	P/S	SW/FW/ PSDA	TOTAL CREDIT UNITS
	1	0	0	0	1

Course Contents/syllabus:

	No. of Session
Unit-1- Individual differences & Personality	**4 H**
• Personality: Definition& Relevance • Importance of nature & nurture in Personality Development • Importance and Recognition of Individual differences in Personality • Accepting and Managing Individual differences Intuition, Judgment, Perception & Sensation (MBTI) BIG5 Factors	
Unit-2- Managing Diversity	**4 H**
• Defining Diversity • Affirmation Action and Managing Diversity • Increasing Diversity in Work Force • Barriers and Challenges in Managing Diversity	
Unit-3- Socialization, Patriotism and National Pride	**4 H**
• Nature of Socialization • Social Interaction • Interaction of Socialization Process • Contributions to Society and Nation • Sense of pride and patriotism • Importance of discipline and hard work • Integrity and accountability	
Unit-4- Human Rights, Values and Ethics	**3 H**
• Meaning and Importance of human rights • Human rights awareness • Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.	

List of Professional Skill Development Activities (PSDA):

- Project on Understanding Diversity
- Term Paper on Patriotism among Youth

Course Learning Outcomes: On completion of the course:

- To recognize individual differences
- To manage individual differences
- To develop patriotic feelings
- To recognize their self in relation to society & nation

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN	Pages
Department of English, University of Delhi	The Individual & Society	Pearson Education	2010	978-8131704172	266
Umang Malhotra	Individual, Society, and the World	iUniverse	2004	978-0595662401	188
Tonja R. Conerly & Kathleen Holmes	Introduction to Sociology 3e	Openstax	2015	9781711493978	458
Daksh Tyagi	"A Nation of Idiots"	Every Protest	2019	978-8194275015	350

Course Title: French Grammar (INL-101)

L	T	P/S	SW/FW	Total Credit Units
1	0	0	0	1

Course Contents/syllabus:

	Teaching Hours
Unit-I: My family and my house	**4 H**
Descriptors/Topics - Talk about your family members - Usage of possessive adjectives	

• Describe your house/apartment	
• Prepositions of location	
• Negation	
Unit-II- Lifestyle	**3 H**
Descriptors/Topics	
• Talk about your hobbies and pastimes	
• Usage of appropriate articles: definite and contracted	
• Talk about your daily routine	
• Usage of pronominal verbs	
Unit-III- In the city	**3 H**
Descriptors/Topics	
• Filling up a simple form	
• Ask for personal information	
• Usage of interrogative adjectives	
• Give directions about a place	
• Ordinal numbers	
• Usage of demonstrative adjectives	
Unit-IV- Week-end	**3 H**
Descriptors/Topics	
• Talk about your week-end plans	
• Usage of disjunctive pronouns	
• Usage of Near Future tense	
• Talk about weather	
• Write a simple post card	

Course Learning Outcomes: At the end of the course, the student shall be able to:

1. Understand information; Express in his own words; Paraphrase; Interpret and translate.

2. Apply information in a new way in a practical context

3. Analyze and break-down information to create new ideas

4. Evaluate and express opinion in a given context

Text / Reference Books:

Author	Title	Publisher	Year of Publication	ISBN No
Christine Andant, Catherine Metton, Annabelle Nachon, Fabienne Nugue,	A Propos - A1, Livre de l'élève et Cahier d'exercices.	Langers International Pvt. Ltd.	2010	978-9380809069
Collins Dictionaries	Easy Learning French Complete Grammar, Verbs and Vocabulary	Collins	2016	978-0008141721
Nikita Desai, Samapita Dey Sarkar	Apprenons La Grammaire Ensemble - French	Langers International Pvt. Ltd.	2017	978-8193002681

Course Title: German Grammar (INL-102)

Course Contents/syllabus:

	Teaching Hours
Module I: Time (Uhrzeit); People and the World: Land, Nationalität und Sprache	**4 H**
- Introduction of time - Read text related to time and teach the students the time expressions - Exercises related to Time - Adverbs of time and time related prepositions - Vocabulary: Countries, Nationalities, and their languages - Negation: "nicht/ kein" - Ja/Nein Fragen. - All the colors and color related vocabulary, adjectives, and opposites - Exercises and comprehension for the same.	
Module II: Irregular verbs (unregelmässige Verben)	**3 H**
- Introduction to irregular verbs and their conjugation e.g. fahren, essen, lesen etc - Read a text related to the eating habits of Germans - Vocabulary: Obst, Gemüse, Kleiderstück with usage of irregular verbs	

• Free time and hobbies • Food and drinks	
Module III: Accusative case: articles and pronouns (Akkusativ Kasus: Artikel und Pronomen)	**3 H**
• Introduction to the concept of object (Akkusativ) • Formation of sentences along with the translation and difference between nominative and accusative articles • Usage of accusative Definite articles • Usage of accusative Indefinite articles	
Module IV: Accusative case: possessive pronouns (Akkusativ Kasus: Possessivpronomen) Family and Relationship	**3 H**
• Accusative Personal Pronouns: - Revision of the nominative personal pronouns and introduction of accusative. Applicability of pronouns for both persons and things. • Usage of accusative Personal Pronouns • Introduction of accusative possessive pronouns • Difference between nominative and accusative possessive pronouns • usage of accusative possessive pronouns	

At the end of the course, the student shall be able to:

1. Understand information; Express in his own words; Paraphrase; Interpret and translate.

2. Apply information in a new way in a practical context

3. Analyze and break-down information to create new ideas

4. Evaluate and express opinion in a given context

Text / Reference Books:

Author	Title	Publisher	Year	ISBN No	Pages
Dora Schulz, Heinz Griesbach	Deutsche Sprachlehre Fur Auslander	Max Hueber Verlag	1984	978-3190010066	-
Hartmut Aufderstrasse, Jutta Muller, Helmut Muller	Themen Aktuell: Glossar Deutsch	Max Hueber Verlag	2003	978-3190816903	-

AUTHOR	TITLE	Publisher				
Giorgio Motta	Wir Plus Grundkurs Deutsch fur Junge Lerner Book German Guide	Goyal Publishers	20 11	9788183 072120	24 8

Course Title: Communication Skills—II (ENG-102)

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Contents/syllabus:

	Teaching Hrs (H)
Unit I: Basic Concepts in Communication	3 H
Towards communicative competence; choosing the appropriate channel and medium of communication; ways to develop communication skills in the areas of Listening, Speaking, Reading, and Writing.	
Unit II: Communication Types	4 H
Nonverbal communication: detailed analysis, KOPPACT (Kinesics, Oculesics, Proxemics, Paralanguage, Artefacts, Chronemics, Tactilics).	
Unit III: Communication and Technology	3 H
Importance of digital literacy and communication on digital platforms.	
Unit IV: Presentation Skills	5 H
Planning, preparation, practice, and performance; audience analysis, audio-visual aids, analyzing the non-verbal communication, methods of delivery: impromptu, extemporaneous, memorization, manuscript, and outlining.	

Course Learning Outcomes:

- Students will be able to understand the need and the methods required to develop communication skills in the areas of listening, speaking, reading, and writing.

- Students will be able to understand the significance of non-verbal communication in various contexts.

- Students will be able to develop an awareness of the role of digital platforms in shaping public psyche, beliefs, and perceptions about social realities and build an informed and critical perspective.

- Students will be able to develop and upgrade their presentation skills.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

P. D. Chaturvedi and Mukesh Chaturvedi	Business Communication: Concepts, Cases and Applications	Pearson Education	2006	9788131701720	
Meenakshi Raman and Prakash Singh	Business Communication	Oxford University Press	2012	9780198077053	
Jeff Butterfield	Soft Skills for Everyone	Cengage Learning	2017	9789353501051	

Course Title: Environmental Studies

Course Contents/syllabus:

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	1	0	0	0	1

	Total Hours
Unit-1- Environmental Pollution	**9 hours**
Environmental Pollution: types, Cause, effects and controls –Air, water, soil, chemical and noise pollution. Nuclear hazard and human health risk Solid waste Management-control measures of urban and industrial waste. Pollution case studies.	
Unit-2- Environmental Policies and practices	**9 hours**
Environmental Policies and practices: Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment laws: Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act, international agreements: Montreal and Kyoto protocols and convention on biological diversity (CBD), The Chemical Weapons Convention (CWC). Natural reserves, tribal population and rights and Human-wildlife conflict in Indian context.	
Unit-3- Human communities and the Environment	**9 hours**

Impacts on environment, human health and welfare. Carbon foot-print. Resettlements and rehabilitation of project affected persons, case studies. Disaster management: floods, earthquake, cyclone and landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).	
Unit-4- Field work	**9 hours**
• Visit to an area to document environmental assets: river/forest/flora/fauna, etc. • Visit to local polluted Site-Urban/Rural/Industrial/Agricultural • Study of common plants, insects, birds and basic principles of identification. • Study of simple ecosystems-pond, river, Delhi Ridge, etc.	

Course Learning Outcomes: At the end of this course, the students will be able to develop:

- Understanding the types of pollution and their impact on environment and human health.

- Understand the environmental concerns and their impact on humans and agriculture.

- Able to analyze the impacts of natural and manmade disaster on human population and settlements.

- Sensitization about the environmental issues and concerns leading to proactive actions to improve the environmental conditions in our daily life.

- Able to imbibe practical approach and solution to solve environmental concerns.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
William P. Cunningham, Mary Ann Cunningham	Principles of Environmental Science	McGraw-Hill	2019	9781 2602 1971 5
William P. Cunningham, Mary Ann Cunningham,	Environmental Science: A global concern,	McGraw-Hill	2021	9781 2603

Barbara Woodworth Saigo					6382 1
Gurjar B. R., Molina L.T., Ojha C.S.P. (Eds.)	Air Pollution: Health and Environmental Impacts	CRC	2010	9781 4398 0962 4
Elaine M.A. and Bugyi G.(Eds.)	Impact of Water Pollution on Human Health and Environmental Sustainability (Practice, Progress, and Proficiency in Sustainability)	Idea Group, U.S	2016	978-1466 6955 97
Bryant E.	Natural Hazards, 5th Edition	Cambridge University Press	2004	978-0521 5374 38
Keith Smith	Environmental Hazards Assessing Risk and Reducing Disaster	Oxford University Press	2013	978-0415 6810 63

Course Title: History and Culture of Punjab

	L	T	P/S	SW/FW	Total Credit Units
Course Contents/syllabus:	1	0	0	0	1

	Weightage (%)
Unit I:	**4H**
1. Introduction of Colonial Rule in Punjab: Annexation of Punjab; Board of Administration. 2. Western Education: Growth of Education and rise of middle classes. 3. Agrarian Development: Commercialization of agriculture; canalization and colonization.	
Unit II:	**4H**
4. Early Socio Religious Reform: Christian Missionaries; Namdharis; Nirankaris. 5. Socio Religious Reform Movements: activities of Arya Samaj; Singh sabhas; Ahmadiyas; Ad Dharam Movement 6. Development of Press & literature: growth of print technology; development in literature	
Unit III:	**4H**

7. Emergence of Political Consciousness: Gadar Movement; Jallianwala Bagh Massacre	
8. Gurudwara Reform Movement; major Morchas; Activities of Babbar Akalis.	
9. Struggle for Freedom: Non-Cooperation Movement; HSRA and Bhagat Singh; Civil Disobedience Movement; Quit India Movement.	
Unit IV:	**3H**
10. Partition and its Aftermath: resettlement; rehabilitation	
11. Post-Independence Punjab: Linguistic Reorganization; Green Revolution.	

Course Learning Outcomes:

1. Understand the history of Punjab region in modern times.
2. Interpret the importance early socio religious reform, movements, developments.
3. Examine the contribution of major reform movements: Gadar, Babbar Akalis and Gurdwara reform morchas.
4. Examine the impact of Partition of Punjab and major changes in Punjab after independence.

Text / Reference Books:

1. Singh, Kirpal: **History and Culture of the Punjab, Part II (Medieval Period)**, Publication Bureau, Punjabi University, Patiala 1990(3rd ed.).

2. Singh, Fauja(ed.): **History of the Punjab, Vol.III,** Punjabi University, Patiala 1972.

3. Grewal, J.S.: **The Sikhs of the Punjab**, the New Cambridge History of India, Orient Longman, Hyderabad,1990.

4. Singh, Khushwant: **A History of the Sikhs, vol I: 1469-1839**, oxford University Press, Delhi, 1991.

5. Chopra, P.N., Puri, B.N**.: A Social, Cultural and Economic History of India**, Vol.II, And Das, M.N. Macmillan, Delhi, 1974.

Course Title: Punjabi Language & Literature (INL-104)

L	T	P/S	SW/FW	Total Credit Units
1	0	0	0	1

Course Contents/syllabus:

Unit I:	**4H**
ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਅਧਿਐਨ(ਕਥਾ ਕਹਾਣੀ)	
Unit II:	**4H**
ਦਫ਼ਤਰੀ ਚਿੱਠੀ-ਪੱਤਰ	

Unit III:	4H
ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਆਕਰਨ ਅਤੇ ਬਣਤਰ 1. ਪੰਜਾਬੀ ਅਰਥ ਬੋਧ 2. ਪੰਜਾਬੀ ਵਾਕ ਬੋਧ	
Unit IV:	3H
ਪੰਜਾਬੀ ਭਾਸ਼ਾ: ਲਿੱਪੀ ਅਤੇ ਉਪਭਾਸ਼ਾਵਾਂ 1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਗੁਰਮੁਖੀ ਲਿੱਪੀ 2. ਭਾਸ਼ਾ, ਉਪਭਾਸ਼ਾ,ਟਕਸਾਲੀ ਭਾਸ਼ਾ ਅਤੇ ਪੰਜਾਬੀ ਦੀਆਂ ਉਪਭਾਸ਼ਾਵਾਂ	

Course Learning Outcomes:

1. Understand modern Punjabi Stories.
2. Interpret the importance of letter writing
3. Analyze the Punjabi language structure and grammar.
4. Examine the impact and importance of Punjabi dialects and Gurmukhi script on Punjabi language.

ਹਵਾਲਾ ਪੁਸਤਕ-ਸੂਚੀ:

1. ਡਾ. ਯਨਵੰਤ ਕੌਰ (ਸੰਪਾ.), **ਕਥਾ ਕਹਾਣੀ**, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ ਚੰਡੀਗੜੁ.

2. ਸੁਰਿੰਦਰ ਸਿੰਘ ਖਹਿਰਾ (ਸੰਪਾ.), **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਆਕਰਨ ਅਤੇ ਬਣਤਰ**,ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ,ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ ਪਟਿਆਲਾ,2015.

3. ਡਾ.ਹਰਕੀਰਤ ਸਿੰਘ, **ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਨ ਅਤੇ ਲੇਖ ਰਚਨਾ**, ਪੰਜਾਬ ਸਟੇਟ ਯੂਨੀਵਰਸਿਟੀ ਟੈਕਸਟ ਬੁੱਕ ਬੋਰਡ,ਚੰਡੀਗੜੁ,1999.

4. ਡਾ. ਹਰਬੰਸ ਸਿੰਘ ਧੀਮਾਨ, **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਵਿਆਕਰਣ**, ਸੰਗਮ ਪਬਲੀਕੇਸ਼ਨ, ਸਮਾਣਾ,2014.

5. ਡਾ. ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼ ਸਿੰਘ, **ਸਿਧਾਂਤਕ ਭਾਸ਼ਾ ਵਿਗਿਆਨ**, ਮਦਾਨ ਪਬਲੀਕੇਸ਼ਨਜ਼,ਪਤਿਆਲਾ, 2002.

6. ਡਾ. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ ਸਿਧਾਂਤ ਅਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਪੰਜਾਬੀ ਭਵਨ,ਲੁਧਿਆਣਾ,2012.

7. ਡਾ. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਸ੍ਰੋਤ ਅਤੇ ਸਰੂਪ**, ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਊਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ,2012

8. ਦੁਨੀ ਚੰਦ੍ਰ, **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਣ**, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਚੰਡੀਗੜੁ.

9. ਜੋਗਿੰਦਰ ਸਿੰਘ ਪੁਆਰ ਅਤੇ ਹੋਰ, **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਨ (ਭਾਗ 1,2,3)**,ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ ਜਲੰਧਰ.

10. ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ, **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਗਿਆਨ**, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ ਜਲੰਧਰ,2010.

Course: Bachelors in Computer Applications

Program Structure
Semester III (2nd year)

Sr. No	Course Code	Course Title	Course Type	Weekly Hours			Credit Units
				L	T	PS	
1		Computer Networks	Core Course	4	0	2	5
2		Database Management System	Core Course	3	0	4	5
3		Programming using Python	Core Course	3	0	4	5
4		Computer Architecture	Core Course	4	0	0	4
5		Introduction to Entrepreneurship	Humanities	3	0	0	3
6		**Open Elective -I	Inter Disciplinary Elective	3	0	0	3
			TOTAL	20	0	10	25
			Total Credits	**Min Required: 25**			
				Semester Credits: 25			

** Open Elective to be taken from the subjects offered by other Schools/departments of AUP.

Course Title: Computer Networks

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
Course Contents/syllabus:	4	0	2	0	5

	Teaching Hours
Unit I: Introduction	**15 H**

Data communications concepts: Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex. Types of Networks: LAN, MAN, WAN Network Topologies: Bus, Star, Ring, Mesh, Tree, Hybrid Communication Channels: Wired transmissions: Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fiber transmission. Communication Switching Techniques: Circuit Switching, Message Switching, Packet Switching.		
Unit II: Network Models and Data Link Layer		**15 H**
Network Reference Models: OSI Reference Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Models. Transmission impairments – Attenuation, Distortion, Noise. Multiplexing – Frequency division, Time division, Wavelength division. Data Link Layer Design Issues: Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP)		
Unit III: MAC Sub Layer & Network Layer		**15 H**
MAC sub layer: CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring) Network Layer: Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking.		
Unit IV: Transport & Application Layer		**15 H**
Transport Layer: Design issues, Elements of transport protocols – Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols. Session, Presentation and Application Layers: Session Layer – Design issues, remote procedure call. Presentation Layer – Design issues, Data compression techniques, Cryptography. Application Layer – Distributed application (client/server, peer to peer, cloud etc.), World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), HTTP as an application layer protocol.		

List of Experiments   (**Total:30 Hours**)

1. Familiarization with networking components and devices: LAN Adapters, Hubs, Switches, Routers etc
2. Familiarization with transmission media and tools: Coaxial cable, UTP cable, Crimping tool, Connectors etc
3. Preparing straight and cross cables
4. Study of various LAN topologies and their creation using network devices, cables and computers
5. Configuration of TCP/IP Protocols in Windows and Linux
6. Implementation of resource sharing (file, printer etc.)
7. Designing and implementing class A, B and C networks
8. Subnet planning and its implementation
9. To configure dynamic IP address for a computer connected to a LAN
10. Use of commands like ping, ipconfig for trouble shooting network related problems
11. Develop a program to compute the Hamming Distance between any two code words
12. Installation of FTP server and client
13. To configure proxy server
14. Familiarization with network simulation tools.

Course Learning Outcomes: After studying this course students will be able to:

1. Highlight the characteristics of various protocols.
2. Define different network technologies and their application.
3. Identify Hardware and software components for designing network.
4. Compare the performance of different network media
5. Implement various configuration settings

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Behrouz A. Forouzan	Data Communication and Networking	TMH	2017	978-1259064753
William Stallings	Data and Computer Communication	Pearson	2017	978-9332586932
Andrew S. Tanenbaum	Computer Networks	Pearson	2013	978-9332518742
Douglas Comer	Internetworking with TCP/IP	Pearson	2015	978-9332550100
W. Richard Stevens	TCP/IP Illustrated	Pearson	2014	978-9332535954

Course Title: Programming using Python

Course Contents/syllabus:

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	0	4	0	5

		Teaching Hours
Unit I: Introduction to Python		**12 H**
Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages. Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators		
Unit II: Control Structures		**11 H**

Control Structures: Decision making statements, Python loops, Python control statements. Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).		
Unit III: Functions and Modules		**12 H**
Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.		
Unit IV: Exception Handling		**11 H**
Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.		

List of Experiments   (Total:60 Hours)

1. Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2. Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3. Compute volume of following 3D shapes: cube, cylinder, cone and sphere.
4. Compute and print roots of quadratic equation $ax2+bx+c=0$, where the values of a, b, and c are input by the user.
5. Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,….
6. Write a program to determine whether a triangle is isosceles or not?
7. Print multiplication table of a number input by the user.
8. Compute sum of natural numbers from one to n number.
9. Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13…..n
10. Compute factorial of a given number.
11. Count occurrence of a digit 5 in a given integer number input by the user.
12. Print Geometric and Harmonic means of a series input by the user.
13. Evaluate the Arithmetic expressions.
14. Print all possible combinations of 4, 5, and 6.
15. Determine prime numbers within a specific range.
16. Count number of persons of age above 60 and below 90.
17. Compute transpose of a matrix.
18. Perform following operations on two matrices.
       1) Addition 2) Subtraction 3) Multiplication
19. Count occurrence of vowels.
20. Count total number of vowels in a word.
21. Determine whether a string is palindrome or not.
22. Perform following operations on a list of numbers:
       1) Insert an element 2) delete an element 3) sort the list 4) delete entire list
23. Display word after Sorting in alphabetical order.
24. Perform sequential search on a list of given numbers.
25. Perform sequential search on ordered list of given numbers.
26. Maintain practical note book as per their serial numbers in library using Python dictionary.
27. Perform following operations on dictionary
       1) Insert 2) delete 3) change
28. Check whether a number is in a given range using functions.

29. Write a Python function that accepts a string and calculates number of upper case letters and lower case letters available in that string.
30. To find the Max of three numbers using functions.
31. Multiply all the numbers in a list using functions.
32. Solve the Fibonacci sequence using recursion.
33. Get the factorial of a non-negative integer using recursion.
34. Write a program to create a module of factorial in Python

Course Learning Outcomes: After studying this course students will be able to:

1. Explain environment, data types, operators used in Python.
2. Compare Python with other programming languages.
3. Outline the use of control structures and numerous native data types with their methods.
4. Design user defined functions, modules, files, and packages and exception handling methods.
5. Learn to handle exceptions in Python.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Programming in Python	Programming in Python	BPB	2017	978-9386551276
R. Nageswara Rao	Core Python Programming	Dreamtech Press	2021	978-9390457151
Martin C. Brown	Python, The complete Reference	Tata Mc. Graw Hill	2018	978-9387572942
A. Martelli, A. Ravenscroft, S. Holden	Python in a Nutshell	Shroff/O'Reilly	2017	978-9352135400

Course Title: Database Management Systems

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	0	4	0	5

Course Contents/syllabus:

		Teaching Hours
Unit I: Introduction		12 H
Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. Introduction to Data Models, Hierarchical, Network and Relational Model, Comparison of Network, Hierarchical and Relational Model, Entity Relationship Model.		
Unit II: Relational Algebra		11 H
Relational Database, Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers.		
Unit III: Normalization		12 H

Introduction to Normalization, First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF).		
Unit IV: Database Recovery and Security		**11 H**
Database Recovery, Concurrency Management, Database Security, Integrity and Control. Structure of a Distributed Database, Design of Distributed Databases.		

List of Experiments   (Total:60 Hours)

1. Used of CREATE, ALTER, RENAME and DROP statement in the database tables (relations)
2. Used of INSERT INTO, DELETE and UPDATE statement in the database tables (relations)
3. Use of simple select statement.
4. Use of select query on two relations
5. Use of nesting of queries.
6. Use of aggregate functions.
7. Use of substring comparison.
8. Use of order by statement.
9. Consider the following schema for a Library Database:
   BOOK (Book_id, Title, Publisher_Name, Pub_Year)
   BOOK_AUTHORS (Book_id, Author_Name)
   PUBLISHER (Name, Address, Phone)
   BOOK_COPIES (Book_id, Branch_id, No-of_Copies)
   BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date)
   LIBRARY_BRANCH (Branch_id, Branch_Name, Address)
   Write SQL queries to
      a) Retrieve details of all books in the library_id, title, name of publisher, authors, number of copies in each branch, etc.
      b) Get the particulars of borrowers who have borrowed more than 3 books between Jan 2018 to Jun 2018
      c) Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
      d) 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
      e) 5. Create a view of all books and its number of copies that are currently available in the Library.
10. Consider the following schema for Order Database:
    SALESMAN (Salesman_id, Name, City, Commission)
    CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id)
    ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
    Write SQL queries to
       a) Count the customers with grades above Amritsar's average.
       b) Find the name and numbers of all salesmen who had more than one customer.
       c) List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)
       d) Create a view that finds the salesman who has the customer with the highest order of a day.

e) 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
11. Write a PL/SQL code to add two numbers and display the result. Read the numbers during run time.
12. Write a PL/SQL code to find sum of first 10 natural numbers using while and for loop.
13. Write a program to create a trigger which will convert the name of a student to upper case before inserting or updating the name column of student table.
14. Write a PL/SQL block to count the number of rows affected by an update statement using SQL%ROWCOUNT
15. Write a PL/SQL block to increase the salary of all doctors by 1000.

Course Learning Outcomes: After studying this course students will be able to:

1. Define the basic concepts of DBMS.
2. Design SQL queries.
3. Illustrate the concept of data normalization with the help of real life examples.
4. Explain the concept of transaction management.
5. Outline features of advanced database management systems.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Bipin C. Desai	An Introduction to Database System	Galgotia	2015	978-8175157521
Abraham Silberschatz, Henry F. Korth, S. Sudharshan	Database System Concepts	Mc-Graw Hill	2021	978-9390727506
Ivan Bayross	SQL, PL/SQL The Programming Language of Oracle	BPB	2010	978-8176569644
C. J. Date, A. Kannan, S. Swamynathan	An Introduction to Database Systems	Pearson	2006	978-8177585568
Raghu Ramakrishnan	Database Management Systems	Mc-Graw Hill	2014	978-8131769591

Course Title: Computer Architecture

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
4	0	0	0	4

Course Contents/syllabus:

		Teaching Hours

Unit I: Introduction		15 H
Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR, NAND & NOR as Universal Gates, Logic Gates Applications. Boolean Algebra: Introduction, Theorems, Simplification of Boolean Expression using Boolean Algebra, SOP & POS Forms, Realization of Boolean Expression using Gates, K-Maps, Simplification of Boolean Expression using K-Maps.		
Unit II: Combinational Circuits		**15 H**
Combinational Logic Circuits: Half Adder & Half Subtractor, Full Adder & Full Subtractor, Parallel Binary Adder, Binary Adder/Subtractor. Combinational Logic Circuits: Multiplexers & Demultiplexers, Implementation of Boolean equations using Multiplexer and Demultiplexer, Encoders & Decoders.		
Unit III: Sequential Circuits		**15 H**
Latch, Flip Flops- R-S Flip-Flop, J-K Flip-Flop, Race Around Condition, Removing Race Around Condition, Master-Slave JK Flip-Flop, D Flip-Flop, T Flip-Flop, Applications of Flip-Flops.		
Unit IV: Computer Organization and Common Bus		**15 H**
Introduction to Computer Organization: Introduction to Computer and CPU (Computer Organization, Computer Design and Computer Architecture), Stored Program Concept- Von Neumann Architecture, Harvard Architecture, RISC and CISC Architecture. Register Transfer and Micro operations- Introduction to Registers, Instruction Format, Types of Instructions- Memory Reference Instructions, Register Reference Instructions and Input-Output Instructions. Common Bus System: Introduction to Common Bus System, Types of Buses (Data Bus, Control Bus, Address Bus), 16-bit Common Bus System--Data Movement among registers using Bus.		

Course Learning Outcomes: After studying this course students will be able to:

1. Identify the various internal and peripheral components of computer system
2. Categorize different number system.
3. Outline the role of various components of computer system.
4. Identify micro-operations.
5. Comment on the design of Combinational & Sequential circuits

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Morris Mano	Computer System Architecture	Pearson	2017	978-9332585607
David A. Patterson and John L. Hennessy	Computer Organization and Design: The Hardware/Software Interface	Elsevier	2016	978-9351073376
Carl Hamacher	Computer Organization and Embedded Systems	TMH	2017	978-9339218317

John P. Hayes	Computer Architecture and Organization	Pearson	2017	978-1259028564
William Stallings	Computer Organization and Architecture: Designing for Performance	Pearson	2016	978-9332570405

Course Title: Introduction to Entrepreneurship

Course Contents

	L	T	P	Total Credits
	3	0	0	3

	Lecture Hours
Unit I: Introduction to Entrepreneurship	**11**
Meaning of Entrepreneurship, Role of Entrepreneurship in Society & Nation Development, Entrepreneurship as Catalyst of Changing the World, Entrepreneurial Styles Activity: Identify your dominant Entrepreneurial Style	
Unit II: Understanding Entrepreneurship Clubs in the Institutions	**12**
Objective & Importance of E-cell, E-cell Activities in Campus, Entrepreneurial Success Stories, Shashank's story Activity in the campus: Dreams activity Idea Planes Activity	
Unit III: Entrepreneurial Skills -I	**11**
Communication Skills, Importance of Communication to an Entrepreneur, Communication Style, Effective Communication for Business Development, Personal Selling, Elevators Pitch, Different types of Markets, Leadership & Motivational Skills. Activity :Quiz, Role play	
Unit IV: : Entrepreneurial Skills -II	**11**
Creativity and Innovation, Role of Creativity & Innovation in Entrepreneurship, Design Thinking, Risk & Resilience, Decision Making, Planning and Organizing. Activity: Design Thinking, Risk & Resilience	

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

- Understand the benefits and limitations of Entrepreneurship
- Formulate and apply entrepreneurial skills to solve daily societal problems.
- Identify various communication strategies for business development,
- Evaluate themselves as responsible entrepreneurs and apply design thinking skills

List of Professional Skill Development Activities (PSDA):

1. During the semester you will interview one entrepreneur mentor and come up with five good business questions you would like to ask him or her.
2. Students will develop an Entrepreneur Journal where reflection and personal experiences will be recorded for future use. Write personal insights, lessons learned, other readings, and the video clips you watch in this semester

Text / Reference Books:

Author	Title	Publisher	Year of publication	ISBN	Pages
Peter F. Drucker	Innovation and Entrepreneurship	Harper Business	2006	978-0060851132	288
Robert J. Calvin	Entrepreneurial Management	McGraw-Hill	2005	9780071450928	295
Robert D. Hisrich, VelandRamadani	Effective Entrepreneurial Management	Springer Publications	2016	9783319504650	230
Steve Mariotti	Entrepreneurship and Small Business Management	Pearson publishers	2014	978-0133767186	720

Course: Bachelors in Computer Applications

Program Structure
Semester IV (2nd year)

Sr. No	Course Code	Course Title	Course Type	Weekly Hours			Credit Units
				L	T	PS	
1		Operating System	Core Course	4	0	2	5
2		Software Engineering	Core Course	4	0	2	5
3		Java Programming	Core Course	3	0	4	5
4		Domain Elective -I	Domain Elective	4	0	2	5
5		Domain Elective -II	Domain Elective	4	0	0	4
			TOTAL	**19**	**0**	**10**	**24**
			Total Credits	**Min Required: 24**			
				Semester Credits: 24			

Domain Elective -I
Programming with PHP
Programming with R
Android Programming

Domain Elective II
Enterprise Resource Planning
Compiler Design
Multimedia Technologies

Course Title: Operating Systems

Course Contents/syllabus:	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	2	0	5

		Teaching Hours
Unit I: Introduction		15 H
Fundamentals of Operating system: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems. Process & Thread Management: Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, Process synchronization		
Unit II: CPU Scheduling		15 H
CPU Scheduling: Need of CPU scheduling, CPU I/O Burst Cycle, Preemptive vs. Non-pre-emptive scheduling, Different scheduling criteria's, scheduling algorithms (FCSC, SJF, Round-Robin, Multilevel Queue).		
Unit III: Memory Management		15 H
Memory Management: Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, page replacement algorithms.		
Unit IV: I/O and File Management		15 H
I/O Device Management: I/O devices and controllers, device drivers; disk storage. File Management: Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection		

List of Experiments   **(Total:60 Hours)**

1. Installation of windows OS.
2. Installation of Linux OS.
3. Dual boot installation of Operating systems.
4. Implementation of FCFS Scheduling algorithm
5. Implementation of SJF Scheduling algorithm
6. Implementation of Round-Robin Scheduling algorithm
7. Vi Editor & its commands
8. Shell Commands
9. Shell Scripting- Using variables
10. Shell Scripting- Input & Output
11. Shell Scripting- Data types

12. Shell Scripting- Use of arithmetic operators
13. Shell Scripting- if control statement programs
14. Shell Scripting- while control statement
15. Shell Scripting- for control statement

Course Learning Outcomes: After studying this course students will be able to:

1. Discuss the evaluation of operating systems.
2. Explain different resource managements performed by operating system.
3. Describe the architecture in terms of functions performed by different types of operating systems.
4. Analyze the performance of different algorithms used in design of operating system components.
5. Compare the key properties of different types of Operating Systems.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Avi Silberschatz, Peter Galvin, Greg Gagne	Operating System Concepts Essentials	Wiley	2014	978-1118804926
William Stallings	Operating Systems: Internals and Design Principles	Prentice Hall	2018	978-9352866717
Charles Crowley	Operating System: A Design-oriented Approach	TMH	2017	978-0074635513
Gary J. Nutt	Operating Systems: A Modern Perspective	Pearson	1997	978-0805312959
Maurice Bach	Design of the Unix Operating Systems	Pearson	2015	978-9332549579

Course Title: Software Engineering

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
Course Contents/syllabus:	4	0	2	0	5

		Teaching Hours
Unit I: Introduction		15 H
The Nature of Software, Need of Software Engineering, Prescriptive Process Models, Specialized Process Models, The Unified Process		
Unit II: Requirement Analysis		15 H
Role of a system analyst, SRS, Properties of a good SRS document, functional and non-functional requirements, Decision tree and Decision table, Formal Requirements Specification, Software Cost Estimation.		
Unit III: Software Design		15 H

Software design and its activities, Preliminary and detailed design activities, Characteristics of a good software design, Features of a design document, Cohesion and Coupling, Structured Analysis, Function Oriented Design, Object-Oriented Design.		
Unit IV: Software Testing		**15 H**
Testing Fundamentals, Unit Testing, Integration Testing, Validation Testing, System Testing, Maintenance and Reengineering, Measures, Metrics, and Indicators, Software Measurement, Metrics for Requirements Model, Metrics for Design Model, Metrics for Testing, Metrics for Maintenance.		

List of Experiments   (Total:30 Hours)

1. Identify project scope and objective of given problem:
    a. College automation system.
    b. Banking Management System.
2. Develop software requirements specification for (1 a.) and (1 b.) problem.
3. Develop UML Use case model for a problem.
4. Develop Class diagrams
5. Represent project Scheduling of above-mentioned projects
6. Use any model for estimating the effort, schedule and cost of software project
7. Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project
8. Develop sequence diagram
9. Develop Structured design for the DFD model developed
10. Develop the waterfall model, prototype model and spiral model of the product
11. Explain with reason which model is best suited for the product
12. Develop a working protocol of any of two problem
13. Use LOC, FP and Cyclomatic Complexity Metric of above-mentioned problem
14. Find Maintainability Index and Reusability Index of above-mentioned problem
15. Using any Case Tool find number of statements, depth and complexity of the prototype

Course Learning Outcomes: After studying this course students will be able to:

1. Highlight the need of software engineering
2. Outline the phases and activities involved in the conventional software life cycle models
3. Design documents for various phases of software life cycle.
4. Compute the complexity of the software based on multiple metrices.
5. Identify the tools needed for different types of documents required in software engineering.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Roger Pressman	"Software Engineering: A Practitioners Approach	Mc-Graw Hill	2009	978-0071267823
Sommerville	Software Engineering	Pearson	2017	978-9332582699
Pankaj Jalote	An integrated approach to Software Engineering	Narosa	2005	978-8173197024

Rajib Mall	Fundamentals of Software Engineering	PHI	2018	978-9388028028
Watts Humphrey	Managing software process	Pearson	2002	978-8177583304

Course Title: Java Programming

Course Contents/syllabus:	**L**	**T**	**P/S**	**SW/FW**	**TOTAL CREDIT UNITS**
	3	**0**	**4**	**0**	**5**

		Teaching Hours
Unit I: Introduction		**12 H**
Java Programming Fundamentals: Introduction to Java, Stage for Java, Origin, Challenges of Java, Java Features, Java Program Development, Object Oriented Programming. Java Essentials: Elements of Java Program, Java API, Variables and Literals, Primitive Data Types, The String class, Variables, Constants, Operators, Scope of Variables & Blocks, Types of Comment in Java.		
Unit II: Control Structure & Object Oriented Java		**11 H**
Control Statements: Decision making statements (if, if-else, nested if, else if ladder, switch, conditional operator), Looping statements (while, do-while, for, nested loops), Jumping statements (Break and Continue). Classes and Objects: Basic concepts of OOPS, Classes and Objects, Modifiers, Passing arguments, Constructors, Overloaded Constructors, Overloaded Operators, Static Class Members, Garbage Collection. Inheritance: Basics of inheritance, Inheriting and Overriding Superclass methods, Calling Superclass Constructor, Polymorphism, Abstract Classes, Final Class.		
Unit III: Arrays, Interfaces & Packages		**12 H**
Arrays and Strings: Introduction to array, Processing Array Contents, Passing array as argument, Returning array from methods, Array of objects, 2D arrays, Array with three or more dimensions. String class, string concatenation, Comparing strings, Substring, Difference between String and String Buffer class, String Tokenizer class. Interface and Packages: Basics of interface, Multiple Interfaces, Multiple Inheritance Using Interface, Multilevel Interface, Packages, Create and Access Packages, Static Import and Package Class, Access Specifiers.		
Unit IV: Exceptions, Multithreading & Applets		**11 H**
Exception Handling: Introduction, Try and Catch Blocks, Multiple Catch, Nested Try, Finally, Throw Statement, Built-In Exceptions Multithreading: Introduction, Threads in Java, Thread Creation, Lifecycle of Thread, Joining a Thread, Thread Scheduler, Thread Priority, Thread Synchronization. Applets: Introduction, Applet Class, Applet Life Cycle, Graphics in Applet, Event-Handling.		

List of Experiments   **(Total:60 Hours)**

1. Write a program to perform following operations on two numbers input by the user:

   1)   Addition 2) subtraction 3) multiplication 4) division

2. Write a Java program to print result of the following operations.
   -15 +58 * 45
   (35+8) % 6
   24 + -5*3 / 7
   15 + 18 / 3 * 2 - 9 % 3

3. Write a Java program to compute area of:

   1)   Circle 2) rectangle 3) triangle 4) square

4. Write a program to convert temperature from Fahrenheit to Celsius degree using Java.
5. Write a program through Java that reads a number in inches, converts it to meters.
6. Write a program to convert minutes into a number of years and days.
7. Write a Java program that prints current time in GMT.
8. Design a program in Java to solve quadratic equations using if, if else
9. Write a Java program to determine greatest number of three numbers.
10. Write program that gets a number from the user and generates an integer between 1 and 7 subsequently should display the name of the weekday as per that number.
11. Construct a Java program to find the number of days in a month.
12. Write a program to sum values of an Single Dimensional array.
13. Design & execute a program in Java to sort a numeric array and a string array.
14. Calculate the average value of array elements through Java Program.
15. Write a Java program to test if an array contains a specific value.
16. Find the index of an array element by writing a program in Java.
17. Write a Java program to remove a specific element from an array.
18. Design a program to copy an array by iterating the array.
19. Write a Java program to insert an element (on a specific position) into Multidimensional array.
20. Write a program to perform following operations on strings:
   i.   Compare two strings.
   ii. Count string length.
   iii. Convert upper case to lower case & vice versa.
   iv. Concatenate two strings.
   v.   Print a substring.
21. Developed Program & design a method to find the smallest number among three numbers.
22. Compute the average of three numbers through a Java Program.
23. Write a Program & design a method to count all vowels in a string.
24. Write a Java method to count all words in a string.
25. Write a method in Java program to count all words in a string.
26. Write a Java program to handle following exceptions:
   Divide by Zero Exception.
   Array Index Out of B bound Exception.

Course Learning Outcomes: After studying this course students will be able to:

1. Define various Object Oriented concepts in Java Programming.
2. Compare different data types in java.
3. Differentiate between built-in and user defined functions/methods, interfaces and packages etc.
4. Outline the importance of exception handling in programs.
5. Explain advanced concepts like multithreading, applet used in java

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Balagurusamy	Programming with Java: A Primer, 6th Ed.	TMH	2019	978-9353162344
Sagayaraja, Denis, Karthik, Gajalakshmi	Java Programming for Core and Advanced Learners,	The Orient Blackswan	2018	978-9386235329
Herbert Schildt and Dale Skrien	Java Fundamentals, A Comprehensive Introduction	McGraw Hill	2017	978-1259006593
H. Schildt	Java, The complete Reference, 11	TMH	2020	978-9390491629

Course Title: Programming with PHP

Course Contents/syllabus:	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	2	0	5

		Teaching Hours
Unit I: Introduction		**15 H**
Evolution of PHP & its comparison Interfaces to External systems, Hardware and Software requirements, PHP Scripting. Basic PHP Development, Working of PHP scripts, Basic PHP syntax, PHP data types. Displaying type information: Testing for a specific data type, Changing type with Set type, Operators, Variable manipulation, Dynamic variables and Variable scope.		
Unit II: Control Statements, Functions and Arrays		**15 H**
Control Statements if() and elseif() condition Statement, The switch statement, Using the? Operator, Using the while() Loop, The do while statement, Using the for() Loop. Functions Function definition, Creation, Returning values, Library Functions, User defined functions, Dynamic function, default arguments, Passing arguments to a function by value. String Manipulation Formatting String for Presentation, Formatting String for Storage, Joining and Splitting String, Comparing String . Array Anatomy of an Array, Creating index based and Associative array, Looping array using each() and foreach() loop.		
Unit III: Forms, Files and Directories		**15 H**

Working with Forms, Super global variables, Super global array, Importing user input, Accessing user input, Combine HTML and PHP code, Using hidden fields, Redirecting the user. Working with File and Directories Understanding file & directory, Opening and closing a file, Coping, renaming and deleting a file, Working with directories, File Uploading & Downloading. Generating Images with PHP: Basics computer Graphics, Creating Image.		
Unit IV: Database Connectivity		**15 H**
Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, Select).		

List of Experiments   **(Total 30 Hours)**

1. Take values from the user and compute sum, subtraction, multiplication, division and exponent of value of the variables.
2. Write a program to find area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3. Compute and print roots of quadratic equation.
4. Write a program to determine whether a triangle is isosceles or not?
5. Print multiplication table of a number input by the user.
6. Calculate sum of natural numbers from one to n number.
7. Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13 21…..n
8. Write a program to find the factorial of any number.
9. Determine prime numbers within a specific range.
10. Write a program to compute, the Average and Grade of students marks.
11. Compute addition, subtraction and multiplication of a matrix.
12. Count total number of vowels in a word "Develop & Empower Individuals".
13. Determine whether a string is palindrome or not?
14. Display word after Sorting in alphabetical order.
15. Check whether a number is in a given range using functions.
16. Write a program accepts a string and calculates number of upper case letters and lower case letters available in that string.
17. Design a program to reverse a string word by word.
18. Write a program to create a login form. On submitting the form, the user should navigate to profile page.
19. Design front page of a college or department using graphics method.
20. Write a program to upload and download files.

Course Learning Outcomes: After studying this course students will be able to:

1. Outline the importance and benefits of PHP
2. Compare Client-Side Script & Server Side Script.
3. Explain the use of control structures, data types used in PHP.
4. Implement database connectivity.
5. Develop Dynamic Website that can interact with different kinds of Database Languages.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

Steven Holzner	PHP: The Complete Reference	Mc Graw Hill	2017	978-0070223622
Kevin Tetroi	Programming PHP	Shroff Publishers	2013	978-9351102113
Robin Nixon	Learning PHP, MySQL, and JavaScript	Shroff Publishers	2015	978-9352130153
Richard Blum	PHP, MySQL & JavaScript All - in - One For Dummies	Wiley	2018	978-8126576005

Course Title: Programming with R

Course Contents/syllabus:	**L**	**T**	**P/S**	**SW/FW**	**TOTAL CREDIT UNITS**
	4	**0**	**2**	**0**	**5**

		Teaching Hours
Unit I: Introduction		**15 H**
Introduction to R, Installing R, Windows/Linux/Mac Installation, Setting up Path, Using Packages, and Running R: Interactive Mode, Batch Mode, Getting Help, Startup and Shut Down.		
Unit II: Vectors, Matrices and Arrays		**15 H**
Scalars, Vectors, Arrays and Matrices, Declarations, Recycling, Common Vector Operations, Using all() and any(), Na and Null Values, Filtering, ifelse() Function Creating Matrices, General Matrix Operations, Applying Functions to Matrix Rows and Columns, Adding & Deleting Matrix Rows and Columns, Difference Between Matrix and Vector.		
Unit III: Lists, tables and structures		**15 H**
Creating Lists, General List Operations, Accessing List Components and Values, Applying Functions to Lists, Recursive Lists. Data Frames: Creating Data Frames, Merging Data Frames, Applying Functions to Data Frames. Factors and Tables: Introduction, Common Functions use with Factors, Working with Tables. R Programming Structures: Control Statements, Arithmetic and Boolean Operators, Default Values for Arguments, Return Values, Recursion.		
Unit IV: Classes & Strings		**15 H**
Concept of Classes, S3 Classes, S4 Classes, S3 Versus S4 Classes, Managing Objects. Input/Output: Accessing Keyboard and Monitor, Reading and Writing Files, Accessing the Internet. String Manipulation: Overview of String Manipulation Functions [grep(), nchar(), paste(), sprintf(), substr(), strsplit(), regexpr(), gregexpr(), Regular expression]		

List of Experiments   **(Total 30 Hours)**

1. Design a program to take input from the user (name and age) and display the values through R Programming.
2. Write a program to get the details of the objects in memory using R Programming.
3. Create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91 using R Programming.
4. Create a vector which contains 10 random integer values between -50 and +50 using R Programming.
5. Demonstrate through a program to display the details of the objects in memory.
6. Write a R program to get the first 10 Fibonacci numbers.
7. Show all prime numbers up to a given number using R Programming..
8. Design a R program to find the factors of a given number.
9. Write a R program to find the maximum and the minimum value of a given vector.
10. Write a program to get the unique elements of a given string and unique numbers of vector.
11. Convert a given matrix to a 1-dimensional array through R programming.
12. Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from the given two vectors.
13. Create a 3 dimensional array of 24 elements using dim() function.
14. Write a R program to create an array using four given columns, three given rows and two given tables, also display the contents of the array.
15. To convert a given matrix to 1 dimensional array design a R program.
16. Write a R program to concatenate two given factor in a single factor.
17. Write a R program to create an 3 dimensional array of 24 elements using the dim() function.
18. Construct a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from the given two vectors. Print the second row of the second matrix of the array and the element in the 3rd row and 3rd column of the 1st matrix.
19. Write a R program to create a data frame from four given vectors.
20. Write a program to get the structure of a given data frame.
21. Design a R program to get the statistical summary and nature of the data of a given data frame.
22. Write a R program to extract specific column from a data frame using column name.
23. Design a R program to create a data frame from four given vectors.
24. Demonstrate a R program to get the structure of a given data frame.
25. Write a R program to get the statistical summary and nature of the data of a given data frame.
26. Design a R program to extract specific column from a data frame using column name.
27. Demonstrate a R program to create a data frame from four given vectors.
28. Write a R program to create a matrix taking a given vector of numbers as input. Display the matrix.
29. Construct a R program to create a matrix taking a given vector of numbers as input and define the column and row names. Display the matrix.
30. Write a R program to access the element at 3rd column and 2nd row, only the 3rd row and only the 4th column of a given matrix.
31. Develop a R program to create a vector of a specified type and length. Create vector of numeric, complex, logical and character types of length 6.
32. Write a R program to add two vectors of integers type and length.
33. Design a R program to append value to a given empty vector
34. Write a R program to multiply two vectors of integers type and length.
35. Design a R program to create a list containing strings, numbers, vectors and a logical values.
36. Write a R program to list containing a vector, a matrix and a list and give names to the elements in the list.
37. Demonstrate a R program to find the levels of factor of a given vector.
38. Write a R program to change the first level of a factor with another level of a given factor.
39. Design a R program to create an ordered factor from data consisting of the names of months.
40. Construct graphical output & display the results of any five tasks using simulator.

Course Learning Outcomes: After studying this course students will be able to:

1. Write programs for arrays and matrices.
2. Execute data frames and lists.
3. Differentiate between arrays from vectors.
4. Implement factors in R
5. Execute minor projects using R.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Norman Matloff	The ART of R Programming	No Starch Press	2011	978-1593273842
Roger D. Peng	R Programming for Data Science	Lulu.com	2012	978-1365056826
S. Rakshit	R Programming for Beginners	Mc Graw Hill	2017	978-9352604555
Seema Acharya	Data Analytics using R	Mc Graw Hill	2018	978-9352605248

Course Title: Android Programming

Course Contents/syllabus:	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	2	0	5

		Teaching Hours
Unit I: Introduction		**15 H**
Characteristics of Mobile applications, Introduction to Android Development Environment, Advantages and Futures of Android, Architecture and working of Android, User-interface design for mobile applications and managing application data.		
Unit II: Integration and Quality Parameters		**15 H**
Integrating cloud services, networking, OS and hardware into mobile applications. Enterprise requirements in mobile applications: Performance, Scalability, Modifiability, Availability and Security.		
Unit III: Mobile Software Engineering		**15 H**
Mobile Software Engineering (Design Principles, Development, Testing methodologies for mobile applications.		
Unit IV: Android Project		**15 H**
Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML.		

List of Experiments   (Total 30 Hours)

1. Installation of Java, android Framework

2. Android SDK Manager and its all components
3. Programs based on the overriding, constructor, classes in Java
4. Programs based on the Final, this and static keyword in Java
5. Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML.
6. Applications based on Text Boxes and Button
7. Applications based on Check Boxes and button
8. Applications based on Radio Buttons
9. Applications based on Intents and Intent Filters
10. Applications based on Activities and services
11. Applications based on Action Bar
12. Applications based on Option Menu
13. Applications based on Rating Bar
14. Applications based on Media Player
15. Applications based on Content Providers
16. Applications based on accessing camera
17. Applications based on accessing location
18. Applications based on the activation of sensors
19. Applications based on Animations

Course Learning Outcomes: After studying this course students will be able to:

1. Prepare environment for working on Android OS.
2. Highlight various security issues in Android platform.
3. Design innovative User Interface and develop activity for android app.
4. Outline the steps for creating database applications.
5. Write programs for basic Android based applications.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Belen Cruz, Zapata	Android Studio Application Development	Packt	2013	978-1783285273
Deitel, P., Deitel, H., Deitle, A., and Morgano, M.	Android for Programmers – An App-Driven Approach	Pearson	2011	978-0132121361
Jeff Mc Wherter, Scottgowell	Professional Mobile Application Development	Wrox	2011	978-1118203903
Reto Meier	Professional Android 4 Application Development	Wiley	2012	978-8126536085
David Mark et al.	Beginning iPhone Development with Swift	Apress	2016	978-1484217535

Course Title: Enterprise Resource Planning

Course Contents/syllabus:

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	0	0	4

		Teaching Hours
Unit I: Introduction		**15 H**
Related Technologies – Business Intelligence – ECommerce and EBusiness – Business Process Reengineering – Data Warehousing – Data Mining – OLAP – Product life Cycle management – SCM – CRM		
Unit II: ERP Implementation		**15 H**
Implementation Challenges – Strategies – Life Cycle – Pre-implementation Tasks – Requirements Definition – Methodologies – Package selection – Project Teams –Process Definitions – Vendors and Consultants – Data Migration – Project management – Post Implementation Activities.		
Unit III: ERP in Business		**15 H**
Operation and Maintenance – Performance – Maximizing the ERP System – Business Modules – Finance – Manufacturing – Human Resources – Plant maintenance – Materials Management – Quality management – Marketing – Sales, Distribution and service		
Unit IV: ERP Market and Applications		**15 H**
Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc – SSA Global – Lawson Software – Epicor – Intutive. ERP Application: Enterprise Application Integration – ERP and E-Business – ERP II – Total quality management – Future Directions – Trends in ERP.		

Course Learning Outcomes: After studying this course students will be able to:

1. Develop model for ERP for large projects
2. Develop model for E-commerce architecture for any application
3. Describe the advantages, strategic value, and organizational impact of utilizing an ERP system for the management of information across the functional areas of a business: sales and marketing, accounting and finance, human resource management, and supply chain
4. Demonstrate a working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process.
5. Evaluate organizational opportunities and challenges in the design system within a business scenario.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Alexis Leon	ERP DEMYSTIFIED	Mc Graw Hill	2014	978-9383286676
Mary Sumner	Enterprise Resource Planning	Pearson	2013	978-1292039800
Jim Mazzullo	SAP R/3 for Everyone	Prentice Hall	2005	978-0131860858

AUTHOR	TITLE	Publisher	Year	ISBN
Jose Antonio Hernandz et al.	The SAP R /3 Handbook	Mc Graw Hill	2006	78-0070634800
Biao Fu	SAP BW: A Step-by-Step Guide	Pearson	2002	978-0201703665

Course Title: Compiler Design

Course Contents/syllabus:

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	0	0	4

		Teaching Hours
Unit I: Introduction		**15 H**
Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA		
Unit II: Syntax Analysis		**15 H**
Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar, Top-Down Parsing – General Strategies Recursive Descent Parser – Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser- LR (0) Item Construction of SLR Parsing Table - Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer-YACC		
Unit III: Intermediate Code Generation		**15 H**
Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.		
Unit IV: Code Optimization & Code Generation		**15 H**
Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management – Issues in Code Generation – Design of a simple Code Generator. Principal Sources of Optimization – Peep-hole optimization – DAG-Optimization of Basic Blocks-Global Data Flow Analysis – Efficient Data Flow Algorithm		

Course Learning Outcomes: After studying this course students will be able to:

1. Build concepts on lexical analysis.
2. Understand strategies of syntax analysis.
3. Learn techniques of Intermediate code generation.
4. Understand code design issues and design code generator.
5. Design and develop optimized codes.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

AUTHOR	TITLE	Publisher	Year	ISBN
A.V. Aho, Monica, R.Sethi, J.D.Ullman	Compilers, Principles, Techniques and Tools	Pearson	2013	978-9332518667
Andrew W. Appel	Modern Compiler Implementation in Java	Cambridge University Press	2002	978-0521820608
J.P. Tremblay and P.G. Sorrenson	The Theory and Practice of Compiler Writing	PSP Books	2005	978-8178000770

Course Title: Multimedia Technologies

Course Contents/syllabus:

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	0	0	4

		Teaching Hours
Unit I: Introduction		**15 H**
Overview of multimedia computing, Definitions, terms, terminologies, characteristics and requirements of different media, Components of multimedia systems. Human's visual and audio system - Characteristics of human visual system, Light and visible light, Human retina structure and functions, Non-perceptual uniform color models and perceptual uniform color models, Characteristics of human's audio system, Frequency response and Magnitude range.		
Unit II: Data Representation and Analysis		**15 H**
Representation of sound/audio, image and video, Speech Generation, Analysis and software, Image analysis, Display and Printing		
Unit III: Coding and Compression		**15 H**
Coding requirements, Compression principles, Entropy and hybrid coding, Compression standards: JPEG and MPEG.		
Unit IV: Multimedia Technology Development		**15 H**
Multimedia technology development - Multimedia history, Technology development, Challenging problem, Research difficulty, Multimedia industry.		

Course Learning Outcomes: After studying this course students will be able to:

1. To acquire fundamental principles of multimedia, including digitization and data compression for non-textual information.
2. To understand core multimedia technologies and standards.
3. To gain insights on various compression standards.
4. To gain hands-on experience in image, sound and video editing.
5. To design, capture, store and integrate sound, images and video to deliver multi-modal information.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

John F. Koegel Buford	Multimedia Systems	Pearson	2021	978-8177588279
Ralf Stienmetz, Klara Nahrstedt	Multimedia: Computing, Communications and Applications	Pearson	2002	978-8177584417
Judith Jeffcoate	Multimedia in Practice: Technology and Applications	Prentice Hall	1995	978-0131233249

Course: Bachelors in Computer Applications

Program Structure
Semester V (3rd year)

Sr. No	Course Code	Course Title	Course Type	Weekly Hours			Credit Units
				L	T	PS	
1		Design and Analysis of Algorithms	Core Course	4	0	2	5
2		Foundations of Artificial Intelligence	Core Course	4	0	2	5
3		Computer Graphics	Core Course	3	0	2	4
4		Domain Elective -III	Domain Elective	4	0	0	4
5		**Open Elective- II	Inter Disciplinary Elective	3	0	0	3
6		*Industrial Training	Non-Teaching Credit Course	0	0	0	2
			TOTAL	**18**	**0**	**06**	**23**
			Total Credits	**Min Required: 23**			
				Semester Credits: 23			

** Open Elective to be taken from the subjects offered by other Schools/departments of AUP.

Domain Elective III (Without Lab)
Information Security
Information System Design and Implementation
Data Warehouse and Mining

** Open Elective to be taken from the subjects offered by other Schools/departments of AUP.

Course Title: Design and Analysis of Algorithms

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
4	0	2	0	5

Course Contents/syllabus:

	Teaching Hours
Unit I: Introduction	**15 H**

Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.		
Unit II: Algorithmic Strategies		**15 H**
Brute-Force, Greedy, Dynamic Programming, Branch- and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving: Knap Sack, TSP.		
Unit III: Graphs & Trees		**15 H**
Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.		
Unit IV: Tractable and In-Tractable problems		**15 H**
Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. .		

List of Experiments (Total: 30 Hours)

1. Code and analyze solutions to following problem with given strategies:
   i. Knap Sack using greedy approach
   ii. Knap Sack using dynamic approach
2. Code and analyze to find an optimal solution to matrix chain multiplication using dynamic programming.
3. Code and analyze to find an optimal solution to TSP using dynamic programming.
4. Implementing an application of DFS such as:
   i. to find the topological sort of a directed acyclic graph
   ii. to find a path from source to goal in a maze.
5. Implement an application of BFS such as:
   to find connected components of an undirected graph
6. Code and analyze to find shortest paths in a graph with positive edge weights using Dijkstra's algorithm.
7. Code and analyze to find the minimum spanning tree in a weighted, undirected graph using Prims' algorithm
8. Code and analyze to find the minimum spanning tree in a weighted, undirected graph using Kruskals' algorithm.
9. Coding any real world problem or TSP algorithm using any heuristic technique.

Course Learning Outcomes: After studying this course students will be able to:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Explain when an algorithmic design situation calls for which design paradigm (greedy/ divide and conquer/backtrack etc.).
3. Explain model for a given engineering problem, using tree or graph, and write the corresponding algorithm to solve the problems.
4. Demonstrate the ways to analyze approximation/randomized algorithms (expected running time, probability of error); &
5. Examine the necessity for NP class-based problems and explain the use of heuristic techniques.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein	Introduction to Algorithms	PHI	2010	978-8120340077
Adam Drozdek	Data Structures and Algorithms in C++	Cengage	2013	978-8131521267
E. Horowitz, Sartaj Saini	Fundamentals of Computer Algorithms	Galgotia Publications	1999	978-817515257
Jon Kleinberg and Éva Tardos	Algorithm Design	Pearson	2013	978-9332518643
Udi Manber	Algorithms -- A Creative Approach	Pearson	1989	978-0201120370

Course Title: Foundations of Artificial Intelligence

Course Contents/syllabus:

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	2	0	5

	Teaching Hours
Unit I: Introduction	**15 H**
What is intelligence? Foundations of artificial intelligence (AI). History of AI. AI problems: Toy Problems, Real World problems- TicTac-Toe, Water Jug, Question-Answering, 8-puzzle, 8-Queens problem. Formulating problems, Searching for Solutions.	
Unit II: Knowledge Representation	**15 H**
Propositional Logic, Propositional Theorem proving-Inference and Proofs, Proof by Resolution, Horn Clauses and definite Clauses, Forward and Backward chaining; First order Logic, Inference in First order Logic. Uncertain Knowledge and Reasoning: Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic. Structured Knowledge: Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.	
Unit III: Uninformed and Informed Search Strategies	**15 H**
Uninformed Search strategies- Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Comparing uninformed search strategies. Informed (Heuristic) Search Strategies-Hill Climbing, Simulated Annealing, Greedy best-first search, A* and optimal search, Memory bounded heuristic search.	
Unit IV: Natural Language Processing & Expert Systems	**15 H**

Grammars, Parsing, Semantic Analysis and Pragmatics. Expert System Architectures: Characteristics, Rule-Based System Architectures, Nonproduction System Architectures, Knowledge Acquisition and Validation	

List of Experiments: **(Total 30 Hours)**

Instructions: Develop the assignments in MATLAB/Python.

1. Learn the building blocks of Logic Programming in Python.
2. Python script for comparing mathematical expressions and finding out unknown values.
3. Use logic programming in Python to check for prime numbers.
4. Use logic programming in Python parse a family tree and infer the relationships between the family members.
5. Python script for building a puzzle solver.
6. Implementation of Naïve Bayes classifier, computing its accuracy and visualizing its performance.
7. Creation of a fuzzy control system which models how you might choose to tip at a restaurant.
8. Implementation of uninformed search techniques in Python.
9. Implementation of heuristic search techniques in Python
10. Python script for tokenizing text data.
11. Extracting the frequency of terms using a Bag of Words model.
12. Predict the category to which a given piece of text belongs.
13. Python code for visualizing audio speech signal
14. Python code for Generating audio signals
15. Python code for Synthesizing tones to generate music

Course Learning Outcomes: After studying this course students will be able to:

1. Highlight the significance and domains of Artificial Intelligence and knowledge representation.
2. Outline the advantages and disadvantages of various search techniques.
3. Identify various Expert Systems and AI applications.
4. Define the role of AI in different areas like NLP.
5. Select the right AI tool for different AI based applications

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Russel and Norvig	Artificial Intelligence-A Modern Approach, 3rd ed.	Prentice Hall	2015	978-9332543515
Elaine Rich, Kevin Knight and SB Nair	Artificial Intelligence	TMH	2017	978-0070087705
D.W. Patterson	Artificial Intelligence And Expert Systems	Prentice Hall	1997	978-8120307773

George F. Luger	Artificial Intelligence Structures and Strategies for complex Problem Solving	Pearson	2008	978-0321545893
Nils J. Nilsson	Artificial Intelligence-A New Synthesis	Elsevier India	2003	978-8181471901

Course Title: Computer Graphics

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	3	0	2	0	4

Course Contents/syllabus:

		Teaching Hours
Unit I: Introduction		12 H
Computer Graphics and its applications, Elements of a Graphics, Graphics Systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Input devices. Scan conversion- Point plot technique, Line drawing, Circle generating and Ellipse generating algorithms		
Unit II: Transformations		11 H
Basic Transformations-Translation, Rotation and Scaling, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing transformations.		
Unit III: Clipping Techniques		11 H
Window to viewport transformation, Clipping Operations- Point Clipping, Line Clipping, Polygon Clipping and Text Clipping. Scan line algorithms, Boundary-fill algorithm, Flood-fill algorithm, Edge fill and fence fill algorithms,		
Unit IV: Filling, 3D-Projections and Visibility		11 H
Scan line algorithms, Boundary-fill algorithm, Flood-fill algorithm, Edge fill and fence fill algorithms. Image and object precision, Hidden edge/surface removal or visible edge/surface determination techniques; z buffer algorithms, Depth sort algorithm, Scan line algorithm and Floating horizon technique.		

List of Experiments   (Total:30 Hours)

1. To plot a point (pixel) on the screen.
2. To draw a straight line using DDA Algorithm.
3. To draw a straight line using Bresenham's Algorithm.
4. Implementation of mid-point circle generating Algorithm.
5. Implementation of ellipse generating Algorithm.
6. To translate an object with translation parameters in X and Y directions.
7. To scale an object with scaling factors along X and Y directions.
8. To rotate an object with a certain angle about origin.
9. Perform the rotation of an object with certain angle about an arbitrary point.
10. To perform composite transformations of an object.
11. To perform the reflection of an object about major axis

Course Learning Outcomes: After studying this course students will be able to:

1. Understand the basics of graphics and scan conversions.
2. Implement various transformations of image planes.
3. Implement various clipping algorithms.
4. Implement and analyze various filling algorithms.
5. Understand Image and Object precision.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Donald Hearn and M. Pauline Baker	Computer Graphics	Pearson	2002	978-8177587654
Zhigand xiang, Roy Plastock	Computer Graphics	Tata Ms Graw Hill	2006	978-0070601659
C, Foley, VanDam, Feiner and Hughes	Computer Graphics Principles & Practice	Pearson	2013	978-0321399526

Course Title: Information Security

Course Contents/syllabus:	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	0	0	4

		Teaching Hours
Unit I: Introduction		**15 H**
The meaning of computer Security, Computer Criminals, Methods of Defense, Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption algorithms, Secure Architecture of an open System. DES and RSA Algorithm. Asymmetric and symmetric Key Cryptography, Role based Security, Digital Signatures, The Data Encryption Standard, The AES Encryption Algorithms, Public Key Encryptions, Uses of Encryption.		
Unit II: Security in Program & OS		**15 H**
Secure Programs, Non malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General- Purpose operating system protected objects and methods of protection memory and addmens protection, File protection Mechanisms, User Authentication Designing Trusted. Operating System: Security polices, models of security, trusted Operating System design, Assurance in trusted Operating System Implementation examples.		
Unit III: Database and Network Security		**15 H**
Database Integration and Secrecy, Inferential Control, Sensitive data, Inference, multilevel database, proposals for multilevel security. Security in Network: Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-Mail		
Unit IV: Administering Security		**15 H**

Security Planning, Risk Analysis, Organizational Security policies, Physical Security. Legal Privacy and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and Employers, Software failures, Computer Crime, Praia, Ethical issues in Computer Security, Case Studies of Corporate Security	

Course Learning Outcomes: After studying this course students will be able to:

1. Identify issues involved in the field of information security.
2. Categorize various types of viruses.
3. Outline the information security risks across de Internet and WWW.
4. Explain different encryption techniques
5. Define cryptography

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Charles P.Pfleeger, Shari Lawrence	Security in Computing	Pearson	2007	978-8131727256
Jason Andress	The Basics of Information Security	Syngress	2014	978-0128007440
Deven N. Shah	Information Security: Principles and Practice	Wiley	2012	978-8126519873
A. Kahate	Cryptography and Network Security	Mc Graw Hill	2019	978-9353163303

Course Title: Information System Design and Implementation

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
4	0	0	0	4

Course Contents/syllabus:

		Teaching Hours
Unit I: Introduction		**15 H**
Definition and characteristics of a system. Elements of a system Environment: Boundaries and interface. Types of systems: Physical or Abstract Systems, Open and Closed System, Man - made information systems. The System Development Life Cycle: Introduction to various phases-Recognition of Need, Feasibility Study, Analysis, Design, Implementation, Post– Implementation and Maintenance. The Role of System Analyst: Skills of a System Analyst, various roles of the Analyst.		
Unit II: Planning and Information Gathering		**15 H**

System Planning and the Initial Investigation: Bases for planning in system analysis, Initial investigation, determining the users information requirements, Problem definition and Project Initiation, Background Analysis, Fact Finding, Fact Analysis, Determination of Feasibility. Information Gathering: Introduction, Information Gathering tools: Review of Literature, Procedures and forms. On -site observation. Interviews and questionnaires. Tools of Structured Analysis: Various tools of structured analysis: Data flow diagram (DFD), Data Dictionary, Decision tree and structured English, Decision table, Pros and cons of each tools.		
Unit III: Feasibility and System Design		**15 H**
Feasibility Study: System Performance-statement of Constraints, Identification of Specific System Objectives, description of Outputs. Feasibility Study – Feasibility considerations, Steps in feasibility analysis. Feasibility Report. System Design: The Process of Design-Logical and Physical Design, Design methodologies: Structured design, Functional Decomposition. System Testing and Quality Assurance: Testing, System testing, Quality assurance and its goals in its system life cycle, Levels of quality assurance, Trends in testing.		
Unit IV: Implementation and Maintenance		**15 H**
Introduction, Conversion- Activity network for Conversion, File Conversion, User Training: Elements of user Training Post implementation review. Software Maintenance - Primary activities of a Maintenance Procedure, Reducing Maintenance Costs. Hardware and Software Selection: Types of Software, Procedure for Hardware/Software selection: Major phases in selection, Evaluation and Validation, Vendor Selection, Post – Installation Review. Software selection- Criteria for Software Selection, the evaluation process.		

Course Learning Outcomes: After studying this course students will be able to:

1. Understand key elements of system Design
2. Understand about planning and information gathering methods.
3. To gain insights on physical and logical design of a system.
4. Implement various testing methodologies.
5. Analyze the quality of an information system.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
E.M. Awad	Systems Analysis and Design	Galgotia	2010	978-8175156180
Hardgrave Bill C. , Siau Keng, Chiang Roger H.L	Systems Analysis and Design : Techniques, Methodologies, Approaches and Architectures	Routledge	2009	978-0765623522

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Perry Edwards, Kathleen Edwards	Systems Analysis and Design	Mc Graw Hill	1993	978-0070195738

Course Title: Data Warehouse and Data Mining

Course Contents/syllabus:	**L**	**T**	**P/S**	**SW/FW**	**TOTAL CREDIT UNITS**
	4	**0**	**0**	**0**	**4**

		Teaching Hours
Unit I: Introduction		**15 H**
Need for strategic information, difference between operational and Informational data stores Data warehouse definition, characteristics, Data warehouse role and structure, OLAP Operations, Data mart, Different between data mart and data warehouse, Approaches to build a data warehouse, Building a data warehouse, Metadata & its types.		
Unit II: Data Pre-processing & Schemas		**15 H**
Data Pre-processing: Need, Data Summarization, Methods. Denormalization, Multidimensional data model, Schemas for multidimensional data (Star schema, Snowflake Schema, Fact Constellation Schema, Difference between different schemas. Data warehouse architecture, OLAP servers, Indexing OLAP Data, OLAP query processing, Data cube computation		
Unit III: Data Mining		**15 H**
Data Mining: Definition, Data Mining process, Data mining methodology, Data mining tasks, Mining various Data types & issues. Attribute-Oriented Induction, Association rule mining, Frequent itemset mining, The Apriori Algorithm, Mining multilevel association rules.		
Unit IV: Classification and Clustering		**15 H**
Overview of classification, Classification process, Decision tree, Decision Tree Induction, Attribute Selection Measures. Overview of classifier's accuracy, Evaluating classifier's accuracy, Techniques for accuracy estimation, Increasing the accuracy of classifier. [CO4] Introduction to Clustering, Types of clusters, Clustering methods, Data visualization & various data visualization tools		

Course Learning Outcomes: After studying this course students will be able to:

1. Highlight the need of Data Warehousing & Mining
2. Differentiate between the Transactional and Analytical data models.
3. Identify the real life applications where data mining can be applied.
4. Apply different data mining algorithms on wide range of data sets.
5. Explain the role of visualization in data representation and analysis.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

A. Berson	Data Warehousing, Data Mining & Olap	Mc Graw Hill	2017	978-0070587410
Han J., Kamber M. and Pei J	Data mining concepts and techniques	Elsevier	2007	978-9380931913
Pudi V., Krishana P.R.	Data Mining	OUP India	2009	978-0195686289
Adriaans P., Zantinge D.	Data mining	Pearson	2002	9788131707173
Pooniah P.	Data Warehousing Fundamentals	Wiley	2012	978-8126537297

Course: Bachelors in Computer Applications

Program Structure
Semester VI (3rd year)

Sr. No	Course Code	Course Title	Course Type	Weekly Hours			Credit Units
				L	T	PS	
1		E-Commerce	Core Course	4	0	0	4
2		Ethical Hacking	Core Course	4	0	0	4
3		Machine learning	Core Course	4	0	2	5
4		Domain Elective -IV	Domain Elective	4	0	2	5
5		Domain Elective -V	Domain Elective	4	0	0	4
6		Major Project	NTCC	0	0	4	2
			TOTAL	**20**	**0**	**08**	**24**
			Total Credits	**Min Required: 24** **Semester Credits: 24**			

Domain Elective IV (With Lab)
Blockchain Technologies
Internet of Things
Cloud Computing

Domain Elective V (Without Lab)
Digital Image Processing

IPR & Cyber Laws
Cyber Security

Course Title: E-Commerce

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
Course Contents/syllabus:					
	4	0	0	0	4

		Teaching Hours
Unit I: Introduction		**15 H**
Definitions: E-commerce, E-business, difference between E-commerce and E-business, Problems with Traditional business systems, Aims of E-commerce, Types of E-commerce: B2B, B2C, C2C, B2G, G2H, G2C, Operational & Strategic benefits of E-commerce, Issues & Challenges in E-commerce. Electronic Data Interchange (EDI): Definition; Traditional versus EDI enabled system for document exchange; Components of EDI: EDI Standards, EDI Software, Communication Networks; EDI Message Structure; EDI Notification Structure; EDI in India; EDI enabled procurement process; Benefits of EDI: Direct Benefits, Strategic Benefits; EDI Implementation issues; Legal Aspects		
Unit II: Web Based E-Commerce		**15 H**
Web based E-Commerce: Definition; Need for web-based business, Steps in setting up business on Internet: Selection & registration of domain name, Website development: Planning a website, Steps for creating a website, Elements of a webpage, web authoring tools, Hosting a website: Website hosting considerations.		
Unit III: Online Promotion Techniques		**15 H**
Online Promotion tools & techniques: Getting links to your site, banner advertisements & measuring advertisement effectiveness; Web Traffic Analysis: Hits, View pages, Visits and Other web-reporting tools, various measures, What is Search Engine optimization		
Unit IV: E-Payment		**15 H**
Electronic Payment Systems: E-cash: Purchasing & using of e-cash; Electronic Purses their loading with cash and use; E-cheque payment system; Online Third Party Verified Payment System through Credit & Debit Cards; ATM based cash disbursement system; Electronic Bill Payment System; Interbank clearing system.		

Course Learning Outcomes: After studying this course students will be able to:

1. Understand the modern electronics-based data Interchange
2. Design websites
3. Use online tools for promotion and advertisements.
4. Analyze Web traffic and optimize search engines.
5. Understand various concepts related to E-payment.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Bhasker, Bharat	Electronic Commerce: Framework, Technologies and Applications	Mc-Graw Hill	2017	978-1259026843
Bajaj, Kamlesh & Nag, Debjani	E-Commerce-The Cutting Edge of Business	Mc-Graw Hill	2017	978-0070585560
Young, Margaret Levine	The Complete Reference: Internet	Mc-Graw Hill	2002	978-0070486997
KalaKota, Ravi & Whinston, Andrew B	Frontiers of Electronic Commerce	Pearson	2015	978-8177583922
Stallings, William	Network Security Essentials: Applications & Standards	Pearson	2018	978-9352866601

Course Title: Ethical Hacking

Course Contents/syllabus:	**L**	**T**	**P/S**	**SW/FW**	**TOTAL CREDIT UNITS**
	4	**0**	**0**	**0**	**4**

		Teaching Hours
Unit I: Introduction		**15 H**
Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking		
Unit II: Foot Printing & Scanning		**15 H**
Foot printing: Authoritative, Non -Auth reply by DNS, Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Scanning: Detecting live systems on the target network, Discovering services running /listening on target systems, Understanding port scanning techniques, Identifying TCP and UDP services running on the target network, Understanding active and passive fingerprinting.		
Unit III: Hacking		**15 H**
System Hacking: Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing. Hacking Wireless Networks: Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Securing Wireless Networks.		
Unit IV: Cryptography		**15 H**

Cryptography: Understand the use of Cryptography over the Internet through PKI, RSA, MD-5, Secure Hash Algorithm and Secure Socket Layer.		

Course Learning Outcomes: After studying this course students will be able to:

1. Understand the significance of Ethical Hacking.
2. Understand the methods of scanning and looking for footprints,
3. Analyze the methods involved in hacking systems and wireless networks.
4. Implement cryptography algorithms,
5. Understand the security aspects need to be adopted against hacking.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Rajat Khare	Network Security and Ethical Hacking	Luniver Press	2006	978-1905986002
Thomas Mathew	Ethical Hacking	OSB Press	2003	9780972936217
Stuart McClure, Joel Scambray and George Kurtz	Hacking Exposed: Network Security Secrets & Solutions	Tata Mc Graw Hill	2012	978-0071780285

Course Title: Machine Learning

Course Contents/syllabus:	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	2	0	5

		Teaching Hours
Unit I: Introduction		15 H
What is Machine Learning, Unsupervised Learning, Reinforcement Learning Machine Learning Use-Cases, Machine Learning Process Flow, Machine Learning Categories, Linear regression and Gradient descent.		
Unit II: Supervised Learning		15 H
Classification and its use cases, Decision Tree, Algorithm for Decision Tree Induction Creating a Perfect Decision Tree, Confusion Matrix, Random Forest. What is Naïve Bayes, How Naïve Bayes works, Implementing Naïve Bayes Classifier, Support Vector Machine, Illustration how Support Vector Machine works, Hyper parameter Optimization, Grid Search Vs Random Search, Implementation of Support Vector Machine for Classification.		
Unit III: Clustering		15 H
What is Clustering & its Use Cases, K-means Clustering, How does K-means algorithm work, C-means Clustering, Hierarchical Clustering, How Hierarchical Clustering works.		
Unit IV: Reinforcement Learning		15 H

Why Reinforcement Learning, Elements of Reinforcement Learning, Exploration vs Exploitation dilemma, Epsilon Greedy Algorithm, Markov Decision Process (MDP) Q values and V values, Q – Learning, α values		

List of Experiments   **(Total:30 Hours)**

1. Read the numeric data from .CSV file and use some basic operation on it Data Types, Creating Tables, Retrieval of Rows using Select Statement,
2. Write a program to demonstrate the working of the decision tree algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Write a program to demonstrate the working of the Random Forest algorithm.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
6. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard heart disease Data Set. You can use Java/Python ML library classes/API.
7. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
8. Write a program to demonstrate the working of the K-means clustering algorithm.
9. Write a program to demonstrate the working of the Support Vector Machine for Classification Algorithm.
10. Write a program to demonstrate the working of the Hierarchical Clustering

Course Learning Outcomes: After studying this course students will be able to:

1. Define the concept of machine learning
2. Outline the key characteristics of machine learning algorithms
3. Compare the performance of different machine learning algorithms
4. Design solution for basic problems using machine learning algorithms
5. Explain the concept of reinforcement learning

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Christopher M. Bishop	Pattern Reorganization and Machine learning	Springer	2010	978-0387310732
Jerome Friedman, Robert Tibshirani and Trevor Hastie.	The elements of Statistical learning	Springer	2017	978-0387848570
Ethem Alpaydin	Introduction to Machine Learning	MIT Press	2020	978-0262043793

Rodrigo F Mello and Moacir Antonelli	Machine Learning, A practical approach on the statistical learning theory	Springer	2018	978-3319949888
Kevin P. Murphy	Machine Learning A probabilistic prospective	MIT Press	2012	978-0262018029

Course Title: Blockchain Technologies

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
Course Contents/syllabus:	4	0	2	0	5

		Teaching Hours
Unit I: Introduction		**15 H**
Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic - Hash Function, Properties of a hash function-Hash pointer and Merkle tree		
Unit II: Bitcoin and Cryptocurrency		**15 H**
A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments Consensus in a Bitcoin network		
Unit III: Bitcoin Consensus		**15 H**
Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment Paxos		
Unit IV: Blockchain Applications		**15 H**
Internet of Things-Medical Record Management System-Block chain in Government and Block chain Security-Block chain Use Cases –Finance.		

List of Experiments   **(Total: 30 Hours)**

1. To Develop Naive Block chain construction.
2. Design Memory Hard algorithm and its Implementation
3. Design Toy application using Blockchain
4. Program to Solve a Mining puzzles using Block chain
5. Hands-On with various open-source simulating tools available for blockchain.

Course Learning Outcomes: After studying this course students will be able to:

1. Understand emerging abstract models for Block chain Technology.
2. Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.

3. Develop conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.
5. Develop the ability to create crypto currencies and give a strong technical understanding of Block chain technologies with an in-depth understanding of applications, open research challenges, and future directions.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Bashir, Imran	Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks	Packt Publishing	2017	978-1787125445
Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Bitcoin and cryptocurrency technologies: a comprehensive introduction	Princeton University Press	2016	978-0691171692
Nakul Shah	Blockchain For Business With Hyperledger Fabric: A Complete Guide To Enterprise Blockchain Implementation Using Hyperledger Fabric	BPB Publication	2019	978-9388511650
Joseph Bonneau et al.	SoK: Research perspectives and challenges for Bitcoin and cryptocurrency	IEEE Symposium on Security and Privacy	2015	DOI 10.1109/SP.2015.14

Course Title: Internet of Things

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
Course Contents/syllabus:	4	0	2	0	5

	Teaching Hours
Unit I: Introduction	**15 H**

Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IOT and Security aspects of IOT.		
Unit II: Data Representation and Analysis		**15 H**
Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python /Node.js /Arduino) for Communication, Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP		
Unit III: Coding and Compression		**15 H**
Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.		
Unit IV: Multimedia Technology Development		**15 H**
IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation		

List of Experiments (Total 30 Hours)

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.

Course Learning Outcomes: After studying this course students will be able to:

1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Understand the concept of authorization and authentication of devices.
5. Develop real life IoT based projects

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Vijay Madisetti, Arshdeep Bahga	Ïnternet of Things: A Hands on Approach	Orient Blackswan Private Limited	2015	978-8173719547
Rahul Dubey	An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications	Cengage Learning	2019	978-8177584417
Pethuru Raj and Anupama C. Raman	The Internet of Things: Enabling Technologies, Platforms, and Use Cases	Auerbach Publications	2017	978-1498761284
Raj Kamal	Internet of Things: Architecture and Design	Mc-Graw Hill	2017	978-9352605224
Adrian McEwen	Designing the Internet of Things	Wiley	2013	978-1118430620

Course Title: Cloud Computing

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
4	0	2	0	5

Course Contents/syllabus:

		Teaching Hours
Unit I: Introduction		**15 H**
Definition of cloud, characteristics of cloud, historical developments & challenges ahead, the vision of cloud computing, Driving factors towards cloud, Comparing grid with utility computing, cloud computing and other computing systems, types of workload patterns for the cloud, IT as a service, Applications of cloud computing.		
Unit II: Cloud Virtualization		**15 H**
Introduction to virtualization techniques, Characteristics of virtualization, Pros and Cons of virtualization Technology, Hypervisors, Types of hypervisors, Multitenancy, Application programming interfaces (API), Elasticity and scalability.		
Unit III: Cloud Service and Deployment Models		**15 H**
Cloud service models, Infrastructure as a service (IaaS) architecture- details and example, Platform as a service (PaaS) architecture- details and example, Software as a service (SaaS) architecture-- details and example, Comparison of cloud service delivery models. Introduction to cloud deployment models, Public clouds, Private clouds, Hybrid clouds, Community clouds, Migration paths for cloud, Selection criteria for cloud deployment.		
Unit IV: Cloud Security		**15 H**

Understanding security risks, Principal security dangers to cloud computing, Internal security breaches, User account and service hijacking, measures to reduce cloud security breaches Case Studies: Comparison of existing Cloud platforms /Web Services		

List of Experiments   **(Total 30 Hours)**

1. Install VirtualBox/VMware Workstation on different OS.
2. Install different operating systems in VMware.
3. Simulate a cloud scenario using simulator.
4. Implement scheduling algorithms.
5. To study cloud security management.
6. To study and implementation of identity management
7. Case Study - Amazon Web Services/Microsoft Azure/Google cloud services.
8. Hands-on exercises on open-source tool like cloudsim.

Course Learning Outcomes: After studying this course students will be able to:

1. Understand the core concepts of the cloud computing paradigm
2. Understanding importance of virtualization along with their technologies
3. Analyze various cloud computing services and apply them to solve problems on the cloud.
4. Analyze various deployment models and apply them to solve problems on the cloud.
5. Implementation of various security strategies for different cloud platform.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski	Cloud Computing: Principles and Paradigms	Wiley	2013	978-8126541256
Anthony T. Velte, Toby J. Velte and Robert Elsenpeter	Cloud Computing: A practical Approach	Mc Graw Hill	2017	978-0070683518
Barrie Sosinsky	Cloud Computing Bible	Wiley	2011	978-0470903568
Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper	Cloud Computing for dummies	Wiley	2009	978-8126524877
Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi	Mastering Cloud Computing	Mc Graw Hill	2017	978-1259029950

Course Title: Digital Image Processing

Course Contents/syllabus:

2 L	T	P/S	SW/FW	TOTAL CREDIT UNITS
4	0	0	0	4

		Teaching Hours
Unit I: Introduction		**15 H**
Introduction to the DIP areas and applications; Components of Digital Image Processing; Elements of Visual Perception; Image Sensing and Acquisition; Image Sampling and Quantization; Relationships between pixels; color models..		
Unit II: Spatial and Frequency Domain		**15 H**
Spatial Domain: Gray level transformations; Histogram processing; Basics of Spatial Filtering; Smoothing and Sharpening Spatial Filtering Frequency Domain: Introduction to Fourier Transform; Smoothing and Sharpening frequency domain filters; Ideal, Butterworth and Gaussian filters Noise models; Mean Filters; Order Statistics; Adaptive filters; Band reject Filters; Band pass Filters; Notch Filters; Optimum Notch Filtering; Inverse Filtering; Wiener filtering		
Unit III: Feature Extraction and Image Segmentation		**15 H**
Feature Extraction: Contour and shape dependent feature extraction, Extraction of textural features Segmentation: Detection of Discontinuities; Edge Linking and Boundary detection; Region based segmentation; Morphological processing- erosion and dilation.		
Unit IV: Image Compression and Encoding		**15 H**
Entropy-based schemes, Transform-based encoding, Predictive encoding and DPCM, Vector quantization, Huffman coding.		

Course Learning Outcomes: After studying this course students will be able to:

1. Understand the basic concepts of DIP.
2. Improve the quality of digital images.
3. Understand and De-noise Digital Images
4. Segment digital images and extract various features from digital images
5. Understand various image compression techniques and apply such techniques to compress digital images for reducing the sizes of digital images.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Rafael C. Gonzales, Richard E. Woods	Digital Image Processing	Pearson	2018	978-9353062989
Anil Jain K	Fundamentals of Digital Image Processing	Pearson	2015	978-9332551916

Willliam K Pratt	Digital Image Processing	Wiley	2010	978-8126526840	
Nick Efford	Digital Image Processing a practical introduction using Java	Addison Wesley	2000	978-0201596236	

Course Title: IPR & Cyber Laws

Course Contents/syllabus:	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	0	0	4

	Teaching Hours
Unit I: Introduction	**10 H**
Overview of Computer and Web Technology, Need for Cyber Law, Jurisdictional Aspects in Cyber Law, Issues of jurisdiction in cyberspace, Types of jurisdictions, Minimum Contacts Theory, Sliding Scale Theory, Effects Test and International targeting, Jurisdiction under IT Act, 2000.	
Unit II: Cyber Crime and Legal Framework	**12 H**
Cyber Crimes against Individuals, Institutions and State: Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber Terrorism, Cyber Defamation; Concept of privacy, Right to Privacy and Data Protection on Internet, Threat to privacy on internet	
Unit III: Intellectual Property	**12 H**
Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, Concept of Patents; Patentability; Non-patentable inventions, Process of obtaining a patent; Rights of a patentee	
Unit IV: Copyright and Trademark	**11 H**
Copyright: Idea-expression Dichotomy, Works Protected by Copyright, Registration of Copyright, Term of Copyright Protection, Rights conferred by Copyright, Doctrine of Fair-use, Infringement and Remedies. **Trademark**: Essential features of a Trademark, Conventional and Contemporary marks, Registration; Grounds for Refusal of Registration; Difference between infringement of Trademark and Passing off; Infringement and Remedies	

Course Learning Outcomes: After studying this course students will be able to:

1. Identify statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Categorize case law and common law to current legal dilemmas in the technology field.
3. Outline the primary forms of intellectual property rights.
4. Compare the different forms of intellectual property protection in terms of their key differences and similarities.
5. Analyze the effects of intellectual property rights on society as a whole.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Anirudh Rastogi	Cyber Law-Law Of Information Technology And Internet	Lexis Nexis	2014	978-9351432548
Vakul Sharma	Information Technology Law and Practice Cyber Laws and Laws Relating to E-Commerce	Universal Law Publishing	2016	978-9350358917
Pankaj Sahrma	Information Security and Cyber Laws	Kataria, S. K., & Sons	2010	978-9350140710
Navneet Nagpal	Intellectual Property Right	Educreation Publishing	2017	978-1545707975
Dr. S.K. singh	Intellectual Property Rights	CENTRAL LAW AGENCY	2019	9788194003649

Course Title: Cyber Security

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
4	0	0	0	4

Course Contents/syllabus:

	Teaching Hours
Unit I: Introduction	**15 H**

Introduction to Cyber Space: History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies, Choosing the Best Browser according to the requirement and email security, Guidelines to choose web browsers, Securing web browser, Antivirus, Email. Guidelines for secure password and wi-fi security: Guidelines for setting up a Secure password, Two-steps Password management, Wi-Fi Security. Guidelines for social media and basic Windows security: Guidelines for social media		
Unit II: Mobile Phone Security and Initiatives		**15 H**
Introduction to mobile phones, Smartphone Security, Android Security, IOS Security. Cyber Security Initiatives in India: Counter Cyber Security Initiatives in India, Cyber Security Exercise, Cyber Security Incident Handling		
Unit III: Online Banking Security		**15 H**
Overview of Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security		
Unit IV: Cyber Security Threats and Mitigation		**15 H**
Cyber Security Threat Landscape, Emerging Cyber Security threats , Cyber Security Techniques, Firewall. IT Security Act and Misc. Topics: IT Act, Hackers-Attacker Countermeasures, Web Application Security ,Digital Infrastructure Security, Defensive Programming		

Course Learning Outcomes: After studying this course students will be able to:

1. Define key knowledge areas of cyber security
2. Justify the need of various measures to protect cyber space
3. Identify various threats to cyber security
4. Take countermeasures against hacking
5. Perform secure online banking.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Anand Shinde	Introduction to Cyber Security: Guide to the World of Cyber Security	Notion Press	2013	978-1637816424
Sanil Nadkarni	Fundamentals of Information Security	BPB	2016	978-9389328400
J.S. Sandhu	Cybersecurity for Executives	Notion Press	2021	979-8885036221
Rajesh Kumar Goutam	Cyber Security Fundamentals	BPB	2021	978-9390684731

George Reynolds, Ralph Stair	Information System	Cengage	2014	978-1259029950
Jatindra Pandey	Introduction to Cyber Security	Uttarakhand Open University	2017	978-93-84813-96-3

Course: Bachelors in Computer Applications with Research (Batch 2023)
Program Structure
Semester VII (Fourth year)

Sr. No	Course Code	Course Title	Course Type	Credit					Credit Units
				L	T	PS			
1		Advanced Python Programming	Core Courses	3	0	2	0	0	4
2		Research Methodology & IPR	Core Courses	4	0	0	0	0	4
3		Soft Computing	Core Courses	3	0	2	0	0	4
4		Secure Communication and Cryptography	Core Courses	3	0	2	0	0	4
5	CAS-609	Mathematical Structures in Computer Science	Allied Science Course	4	0	0	0	0	4
6		Research Project -I	NTCC	0	0	0	0	0	4
			TOTAL	**17**	**0**	**06**			**24**
		Total Credits					**Min Required: 24**		
							Semester Credits: 24		

Course Title: Advanced Python Programming

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
Course Contents/syllabus:	3	0	2	0	4

		Teaching Hours
Unit I: Introduction		14 H
Basics Objects and Standard Types, Functions, Categorizing the Standard Types, Unsupported Types Numbers - Introduction to Numbers, Integers, Operators, Built-in Functions, Related Modules Sequences - Strings, Lists, and Tuples, Maps, Sets.		
Unit II: Exception Handling and File handling		13 H
Regular Expression in Python, Exceptions in Python, Detecting and Handling Exceptions. FILES: File Objects, File Built-in Functions, Attributes, Standard Files.		
Unit III: Numerical Processing and Data analysis using Python		14 H
Libraries: Python Numpy, Various operations.: Indexing, Slicing, Arrays, Mathematical operations, Python Pandas and its functions.		
Unit IV: Graphic Programming in Python		13 H
GUI Programming: Introduction, Tkinter. Introduction to GUI building libraries. Graphics Programming: Using Graphical Objects, Displaying Images, Colours, buttons etc.		

List of Experiments   (Total:36 Hours)

1. Perform installation of python, of jupyter notebook
2. Execute a basic python program with a print message.
3. WAP to implement show Operators Precedence and loops.
4. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
5. Write a program in Python to search for a given pattern in a string input by user.
6. WAP to Count Uppercase, Lowercase, special character and numeric values using Regex.
7. WAP to get number of characters, words, spaces and lines in a file
8. WAP to Count the Number of occurrences of a key-value pair in a text file.
9. WAP to implement exception handling in python program.
10. Implement Numpy library and perform operations: arrays, Slicing, Indexing etc.
11. Implement Pandas data structures – Series and DataFrame with following operations: Loading a dataset, Selecting Columns, Selecting Rows, Adding new data in a dataframe.
12. Perform GUI building using python libraries implement: buttons, text widgets, menu widget etc.

Course Learning Outcomes: After studying this course students will be able to:

1. Understand and revise the standard programming constructs such as, repetitions, functions, modules, aggregated data, operators, data structures in python.
2. Develop programs using exception handling mechanism and file handling.
3. Learn the use of numerical and data analysis libraries in python.
4. Develop a GUI based application using the concepts of python.
5. Implement object-oriented principles via python programming.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Paul Barry	Head First Python	O'Reilly Media, Inc.	2016	9781491919538
Allen B. Downey	Think Python: How to Think Like a Computer Scientist	O'Reilly.	2015	978-1491939369.
Wes McKinney	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython	O'Reilly	2017	978-1491957660.
Klosterman, Stephen	Data Science Projects with Python: A Case Study Approach to Successful Data Science Projects Using Python	Packt Publishing Limited	2019	978-1838551025.

Course Title: Research Methodology and IPR

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
4	0	0	0	4

Course Contents/syllabus:

		Teaching Hours
Unit I: Introduction		**15 H**
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.		
Unit II: Literature and Report Writing		**15 H**
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper		
Unit III: Developing and reviewing research proposal		**15 H**

Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee		
Unit IV: IPR		**15 H**
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.		

Course Learning Outcomes: After studying this course students will be able to:

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Stuart Melville and Wayne Goddar	Research methodology: An Introduction	Juta Academic	2014	978-0702156601
Wayne Goddard and Stuart Melvill	Research Methodology: An Introduction	Juta Academic	2014	978-0702156601
Ranjit Kumar	Research Methodology: A Step by Step Guide for beginners	Pearson	2005	978-8131704967
Halbert	Resisting Intellectual Property	Routledge	2006	978-3131658111
Robert P. Merges, Peter S. Menell, Mark A. Lemley	Intellectual Property in New Technological Age	Clause 8	2016	978-1945555008

Course Title: Soft Computing

Course Contents/syllabus:

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	0	2	0	4

	Teaching Hours
Unit I: Introduction	**12 H**
Biological Neural Network: Structure and working, Artificial Neural Networks & Applications, Fundamentals, Characteristics, History of neural networks, characteristics of neural networks terminology	
Unit II: Neural Network Models	**11 H**
Models of neuron McCulloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture, Multilayer Neural Networks	
Unit III: Learning methods and propagation	**11 H**
Learning Methods, Backpropagation, Counter propagation, ART, BAM, Associative memories	
Unit IV: Fuzzy Logic	**11 H**
Fuzzy sets, Fuzzy model, Fuzzy rule generation Fuzzy inference system, Defuzzification Introduction to Neuro-Fuzzy system, Architecture and its applications. Applications: Genetic Algorithms.	

List of Experiments   (Total:30 Hours)

1. Implement OR, AND Using Perceptron.
2. Implement OR, AND X-OR gate, Using back propagation algorithm
3. Apply operations using Fuzzy Logic.
4. Apply operations using Neuro Fuzzy Logic.
5. Implement the problem of max-min composition using fuzzy logics.
6. To find the solution of the function Maximize, given the constraints using GA approach

Course Learning Outcomes: After studying this course students will be able to:

1. Understand the concept of soft computing techniques and their use to solve real life problems.
2. Implement various fuzzy logic problems and evaluate their performance.
3. Analyze real world problems and identify the soft computing approaches and tools that should be applied.
4. Understand the concept of neural networks and their relationship with other learning models.
5. Apply various tool and techniques on application domains related to fuzzy, GA.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

Jyh-Shing Roger Jang	Neuro fuzzy and soft computing	Pearson Education	1996	978-0132610667
Kecman	Learning and Soft Computing	Pearson Education	2001	978-8131703052
George Klir , Bo Yuan	Fuzzy Sets and Fuzzy Logic	PHI	1995	978-0131011717
Fu	Neural Network in computer Intelligence	TMH	2003	978-0070532823

Course Title: Secure Communication and Cryptography

Course Contents/syllabus:	**L**	**T**	**P/S**	**SW/FW**	**TOTAL CREDIT UNITS**
	3	**0**	**2**	**0**	**4**

		Teaching Hours
Unit I: Introduction:		**11 H**
Introduction on security, security goals, targets and types of attacks: Passive attack, active attack, attacks on confidentiality, attacks on integrity and availability, Security services and mechanisms.		
Unit II: – **Block Cipher and Data Encryption Standards:**		**12 H**
Block Cipher Principles, Data Encryption Standards, the Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles, Evaluation Criteria for AES, the AES Cipher.		
Unit III: Public Key Cryptography And RSA:		**12 H**
Principles Public key crypto Systems, Diffie Hellman Key Exchange, the RSA algorithm, Key Management, Distribution of public key, public key certificates, Distribution of secret keys, Diffie Hellman key exchange – Man-in-the Middle Attack		
Unit IV: Message Authentication and Hash Functions:		**10 H**
Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs, Hash Algorithms - SHA, One-way hash functions and their applications, Intrusion Detection Systems Overview		

List of Experiments   (Total:30 Hours)

1. Program to implement Ceaser Cipher
2. Program to implement Playfair Cipher with key ldrp
3. Program to implement polyalphabetic Cipher
4. Program to implement AutoKey Cipher
5. Program to implement Hill Cipher.
6. Program to implement Advanced Columner Transposition technique
7. Program to implement Simple RSA Algorithm with small numbers

8. Program to implement Euclidean Algorithm

Course Learning Outcomes: After studying this course students will be able to:

1. Understand cryptography and network security concepts and application
2. Apply security principles to system design.
3. Identify and investigate network security threat.
4. Analyze and design network security protocols
5. Conduct research in network security

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Douglas R. Stinson	Cryptography: Theory and Practice	CRC Press	2018	978-1138197015
William Stallings	Network Security Essentials: Applications and Standards	Prentice Hall	2017	978-9332585225
Wenbo Mao	Modern Cryptography: Theory and Practice	Pearson	2008	978-8131702123
William Stallings	Cryptography And Network Security Principles and Practice	Pearson Education	2017	978-9332585225

Course Title: Mathematical Structures in Computer Science

Course Contents/syllabus:	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	4	0	0	0	4

	Teaching Hours
Unit I: Logic and Proof Techniques	**15 H**
Sets and Subsets, Operations on Sets, Sequence. Logic: Proposition and Logical Operations, Methods of Proof, Mathematical Induction. Mathematics Logic: Statements and Notation, Connectives, Normal forms, The Theory of Interface for The Statement Calculus, Inference Theory of The Predicate Calculus	

Unit II: Relation and Diagraph function	15 H
Counting: Permutation, Combination. Relational and Digraphs: Product Sets and Partitions, Relations and Digraphs, Paths in Relations and Digraphs Properties of Relations, Equivalence Relations, Computer Representation of Relations and Digraph, Manipulation of Relations, Transitive Closure. Functions: Definition and Introduction, Function for Computer Science, Permutation Functions,	
Unit III: Graph Theory, Boolean and Tree	15 H
Graph Theory: Basic Concept of Graph Theory, Euler Paths and Circuits, Hamiltonian Paths and Circuits. Other Relations and Structure- Partially ordered Sets, Lattices Finite. Boolean: Algebra, Functions of Boolean Algebras, Boolean Function as Boolean Polynomials. Tree- Introduction Undirected Tree, Minimal Spanning Trees.	
Unit IV: Group theory	15 H
Group, subgroup, Binary Operations Revisited Semigroups, Products and Quotations of Groups. Introduction to Computability, Languages Finite State Machines, Semigroup, Machines and Language.	

(Total: 60 Hours)

Course Learning Outcomes: On the successful completion of this course the student will be able to

1. Construct mathematical arguments using logical connectives and quantifiers.
2. Verify the correctness of an argument using symbolic logic and truth tables.
3. Construct proofs using direct proof, proof by contradiction, and proof by cases, or mathematical induction.
4. Perform operations on discrete structures such as sets, functions, relations, sequences, and groups.
5. Understand the basics of graph theory, Lattices, and their applications

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

Rosen K.	Discrete Mathematics and Its Applications	7th Edition, Tata McGraw-Hill Education	2011	9780070681880, 0070681880
Tremblay J. P. and Manohar R.	Discrete Mathematical Structures with Applications to Computer Science	Tata McGraw-Hill Education	1997	9780074631133, 9780074631133
Kolman B., Busby R. and Ross S. C.	Discrete Mathematical Structures	6th Edition, Pearson	2015	9789332549593, 8131755541

Course: Bachelors in Computer Applications with Research (Batch 2023)
Program Structure
Semester VIII (Fourth year)

Sr. No	Course Code	Course Title	Course Type	Credit					Credit Units
				L	T	PS			
1		Statistics and Data Analysis	Allied Science Course	4	0	0	0	0	4
2		Risk Analysis and Assessment	Core Courses	3	0	2	0	0	4
3		Virtualization and Cloud Architecture	Core Courses	3	0	2	0	0	4
4		Web And Mobile Security	Core Courses	3	0	2	0	0	4
5		Research Project -II	NTCC	0	0	0	0	0	8
			TOTAL	**13**	**0**	**06**			**24**
		Total Credits					**Min Required: 24**		
							Semester Credits: 24		

Course Title: Statistics and Data Analysis

L	T	P	TOTAL CREDIT UNITS
4	0	0	4

Course Contents/syllabus:

	Teaching Hours
Unit I	**15 H**
Data collection and graphical presentation, Measures of central tendency, Measures of dispersion, Skewness and Kurtosis, Correlation and Regression. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability and Independence, Bayes' theorem, and its applications. Random variable, Expectation and Moment generating function.	
Unit II	**15 H**
Discrete distributions: Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric, and their properties. Continuous distributions: Uniform, Exponential, Gamma, Beta, Weibull, Normal and Lognormal, and their properties. Transformation of random variable, Multiple random variable, Joint and Marginal distributions, Bivariate transformation, Covariance and correlation.	
Unit III	**15 H**
Random sample and sampling distribution, Chi square, t and F-distributions, Order Statistics, Concepts of sufficiency principle and unbiasedness. Point and Interval estimation, Random sample generation.	
Unit IV	**15 H**
Hypothesis testing, one and two-tail test, Z-test, Chi test, t-test, F-test, analysis of varianc and regression	

Course Learning Outcomes: On the successful completion of this course the student will be able to understand the

1. Basics of descriptive statistics and probability theory
2. Use of statistical distributions and their applications in the real-world problems
3. concepts of random sampling and sampling distribution
4. various statistical tests to analyze the data statistically

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

Rohatgi V. K. and Saleh, A.K. Md. E.	An Introduction to Probability and Statistics	2nd Edition, John Wiley and Sons	2009	9788126519262, 9788126519262
Casella G. and Berger R. L.	Statistical Inference	2nd Edition, Cengage Learning India	2002	9788131503942, 9788131503942
Hogg R. V., Mckean J. and Craig A. T	Introduction to Mathematical Statistics	7th Edition, Pearson Education India	2013	9789332519114, 9789332519114
Mukhopadhyay P	Mathematical Statistics	Books and Allied	2016	9788187134930

Course Title: Risk Analysis & Assessment

Course Contents/syllabus:	**L**	**T**	**P/S**	**SW/FW**	**TOTAL CREDIT UNITS**
	3	**0**	**2**	**0**	**4**

		Teaching Hours
Unit I: Introduction		**12 H**
Cybersecurity risk Terminologies, position of risk analysis and management in relation to the other components of a cybersecurity programme. Principles: Assets, vulnerabilities, threats, threat actors, likelihood. Management of risks compared to simple acceptance. Risk treatment options: avoidance, mitigation, transfer, acceptance.		
Unit II: Assets and Vulnerabilities		**11 H**
Assets: Tangible and intangible assets in the cyber world (hardware / software / data, classification, criticality analysis, dependencies, potential for critical national infrastructure. Vulnerabilities: Sources of cyber vulnerability, complexity of modern software, attack surface of modern systems, development of software for functionality and not with security considerations, zero-day system vulnerabilities, vulnerability databases and open information.		

Unit III: Threats and Risk analysis		11 H
Threats: Cyber threat categorization, sources, motivation, type, technical vs. non-technical, threat actors, exploitation of cyber vulnerabilities leading to impact and associated likelihood. Risk analysis: Risk as a combination of possible impact of a threat exploiting a vulnerability and its probability, evaluation of cyber risks, categorization, qualitative and quantitative risk analysis, pre-requisites for meaningful quantitative cyber risk assessment, methodologies, risk register.		
Unit IV: Risk management and Assessment		11 H
Risk management/ Assessment: Risk evaluation, Risk treatment options, risk avoidance, mitigation, transfer, acceptance, risk management as an iterative process, risk profile stemming from modifications in an organisation's environment, building an organisation's cybersecurity control environment from the results of risk analysis, cybersecurity controls.		

List of Experiments   **(Total:30 Hours)**

1. Perform. a Simple Risk Assessment
2. Conduct a risk assessment Case Study
3. Analyze various formal Risk Assessment Tools
4. Perform log parsing to identify risks.
5. Analyze some of the cyber-attacks like ransomware and data leaks.

Course Learning Outcomes: After studying this course students will be able to:

1. To understand and apply principles of risk analysis and assessment and their benefits.
2. Acquire understanding of terminologies of risk, analysis, management, vulnerability, threats, actors, impact, etc.
3. Perform a complete risk assessment.
4. Distinguish between various of different risk assessment/management methodologies and assets.
5. Evaluate and select appropriate risk treatment options according to the combination of impacts.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Evan Wheeler	Security Risk Management: Building an Information Security Risk Management Program from the Ground Up	Syngress	2011	978-1597496155

Douglas W. Hubbard and Richard Seiersen	How to Measure Anything in Cybersecurity Risk	Audible Studios	2016	978-1536669749
Anne Kohnke and Dan Shoemaker	The Complete Guide to Cybersecurity Risks and Controls	Auerbach Publications	2016	978-1498740548
Carl Young	Metrics and Methods for Security Risk Management	Syngress	2010	978-1856179782

Course Title: Risk Analysis & Assessment

Course Contents/syllabus:

	L	T	P/S	SW/FW	TOTAL CREDIT UNITS
	3	0	2	0	4

		Teaching Hours
Unit I: Introduction		**12 H**
Cybersecurity risk Terminologies, position of risk analysis and management in relation to the other components of a cybersecurity programme. Principles: Assets, vulnerabilities, threats, threat actors, likelihood. Management of risks compared to simple acceptance. Risk treatment options: avoidance, mitigation, transfer, acceptance.		
Unit II: Assets and Vulnerabilities		**11 H**
Assets: Tangible and intangible assets in the cyber world (hardware / software / data, classification, criticality analysis, dependencies, potential for critical national infrastructure. Vulnerabilities: Sources of cyber vulnerability, complexity of modern software, attack surface of modern systems, development of software for functionality and not with security considerations, zero-day system vulnerabilities, vulnerability databases and open information.		
Unit III: Threats and Risk analysis		**11 H**

Threats: Cyber threat categorization, sources, motivation, type, technical vs. non-technical, threat actors, exploitation of cyber vulnerabilities leading to impact and associated likelihood. Risk analysis: Risk as a combination of possible impact of a threat exploiting a vulnerability and its probability, evaluation of cyber risks, categorization, qualitative and quantitative risk analysis, pre-requisites for meaningful quantitative cyber risk assessment, methodologies, risk register.		
Unit IV: Risk management and Assessment		**11 H**
Risk management/ Assessment: Risk evaluation, Risk treatment options, risk avoidance, mitigation, transfer, acceptance, risk management as an iterative process, risk profile stemming from modifications in an organisation's environment, building an organisation's cybersecurity control environment from the results of risk analysis, cybersecurity controls.		

List of Experiments   (Total:30 Hours)

1. Perform. a Simple Risk Assessment
2. Conduct a risk assessment Case Study
3. Analyze various formal Risk Assessment Tools
4. Perform log parsing to identify risks.
5. Analyze some of the cyber-attacks like ransomware and data leaks.

Course Learning Outcomes: After studying this course students will be able to:

1. To understand and apply principles of risk analysis and assessment and their benefits.
2. Acquire understanding of terminologies of risk, analysis, management, vulnerability, threats, actors, impact, etc.
3. Perform a complete risk assessment.
4. Distinguish between various of different risk assessment/management methodologies and assets.
5. Evaluate and select appropriate risk treatment options according to the combination of impacts.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Evan Wheeler	Security Risk Management: Building an Information Security Risk Management Program from the Ground Up	Syngress	2011	978-1597496155

Douglas W. Hubbard and Richard Seiersen	How to Measure Anything in Cybersecurity Risk	Audible Studios	2016	978-1536669749
Anne Kohnke and Dan Shoemaker	The Complete Guide to Cybersecurity Risks and Controls	Auerbach Publications	2016	978-1498740548
Carl Young	Metrics and Methods for Security Risk Management	Syngress	2010	978-1856179782

Course Title: Web and Mobile Security

Course Contents/syllabus:

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	0	2	0	4

		Teaching Hours
Unit I: Web Application Vulnerabilities:		12 H
Introduction to Web Application, Web Functionality, OWASP Top 10 Vulnerabilities, SQL Injection: SQL commands using XAMPP, NoSQL Injection, Manual SQL (Union Based), Authentication Based SQL Injection, Error Based SQL Injection, Blind SQL Injection, Boolean Based Blind SQL Injection, Time Based SQL Injection, Brute force attack, Path Traversal Attacks		
Unit II: – **Broken Authentication and Sensitive Data Exposure Vulnerabilities:**		12 H
Broken Authentication/ session id, Types of Broken Authentication, Weak Session ID, Improper Error Handling, Session Management, **Authentication Security:** Authentication Techniques, Design Flaws in Authentication, Implementation Flaws in Authentication, Securing Authentication		
Unit III: Scripting Attacks:		10 H
Introduction to JavaScript, **Cross Site Scripting (XSS):** Types of Cross site scripting: Reflected XSS, Stored XSS, DOM XSS, XSS in Real World, Finding and Exploiting XSS Vulnerabilities, Preventing XSS Attacks		
Unit IV: Mobile Security and its Exploitation:		11 H
Common Mobile Threats, Mobile platform access and application analysis. Manipulating application behavior, Mobile access Trojans. Exploit using AndroRAT. Web Framework Attacks: Exploiting Mobile application using Metasploit. Client-side injection attacks, Unlocking, rooting mobile devices, Weak wireless attacks.		

List of Experiments   **(Total:30 Hours)**

1. Installation of XAMPP and creating Database and performing various commands of SQL
2. Implement Blind Based SQL injection in SQLi/Less-8/?id=1
3. Implement Broken Authentication and Session Management for: Insecure login Form
4. Implement Directory Traversal (Directories), Directory Traversal (Files) on vulnerable application.
5. Implement cross site request forgery (CSRF) using Burp Suite.
6. Identify and exploit Joomla Vulnerabilities and implement various attacks on it
7. Hack an Android device using ANDROID RAT
8. Data extraction from Android smart phone using mobile forensic tools
9. Exploit an Android device using Metasploit Framework
10. Implement Server-side request forgery (SSRF) using with and without Burp suite

Course Learning Outcomes: After studying this course students will be able to:

1. Develop skills to design applications to host on server and to understand the Social Engineering Techniques and Tools
2. Ability to discover top 10 OWASP Vulnerabilities in web applications and analyze them using various vulnerable applications and tools.
3. Discovering the Insights into common web application attacks, Exploit and Mitigate.
4. Exploits and expose XSS, sensitive data and security mis-configuration vulnerabilities in Web Apps
5. Identify threats, Analyze and Exploit mobile applications and Apply best practices to secure them

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Bryan Sullivan and Vincent Liu	Web Application Security: A beginner Guide	McGraw-Hill Education	2011	978-0071776165
Steven Furnell	Mobile Security: a pocket Guide	IT Governance Publishing	2009	978-1849280204
Nikolay Elenkov	Android Security Internals: An In-Depth Guide to Android's Security Architecture	No Starch Press	2014	978-1593275815
Ben Walther and Paco Hope	Web Security Testing Cookbook: Systematic Techniques to Find Problems fast	O'Reilly Media	2008	978-0596514839