Courses of Study

(Detailed Course Contents)

Bachelor of Technology

Computer Science & Engineering

(2020-2024 Batch)

Shri Mata Vaishno Devi University

Kakryal, Katra 182320 Jammu & Kashmir

VISION

Establishment of a Scientific & Technical University of Excellence to nurture young and talented human resources for the service of Indian Society & world at large and preserving the integrity and sanctity of human values.

MISSION

The mission of the University is the pursuit of Education, Scholarship and Research at the highest International level of excellence.

OBJECTIVES

- Provide education and training of excellent quality, both at undergraduate and postgraduate level.
- Ensure that the University achieves and maintains an international standing in both teaching and research
- Promote study and research in new and emerging areas and encourage academic interaction of the faculty and the students at national and international levels.
- Encourage close collaboration with industry and facilitate the application of research for commercial use and for the benefit of society.

University Campus Address	Shri Mata Vaishno Devi University Kakryal, Katra 182 320 J&K, INDIA Phone:01991-285634, 285524 Fax: 01991-285694
Public Relations Officer Address	Public Relations Office, ShriMataVaishnoDeviUniversity Saraswati Dham, Near Railway Station, Jammu-180004 J&K, INDIA Telefax: 0191-

Website: www.smvdu.ac.in
Facebook:
Instagram:
LinkdIn:
Twitter:

1.0 Introduction

Shri Mata Vaishno Devi University (SMVDU) has adopted the Indian Institutes of Technology (IIT) pattern of teaching and examination system in its endeavor to attain academic excellence. The University is offering graduate and postgraduate programs since 2004. The university also offers programs leading to award of PhD degree. The programs being offered from the academic session 2013-14are mentioned below.

2.0 Programs of Study

The following programs of study are being offered by the university in the academic session 2023-24.

Undergraduate Programs

1. Bachelor of Technology in Computer Science & Engineering
2. Bachelor of Technology in Electronics &Communication Engineering
3. Bachelor of Technology in Mechanical Engineering
4. Bachelor of Technology in Industrial Biotechnology
5. Bachelor of Architecture

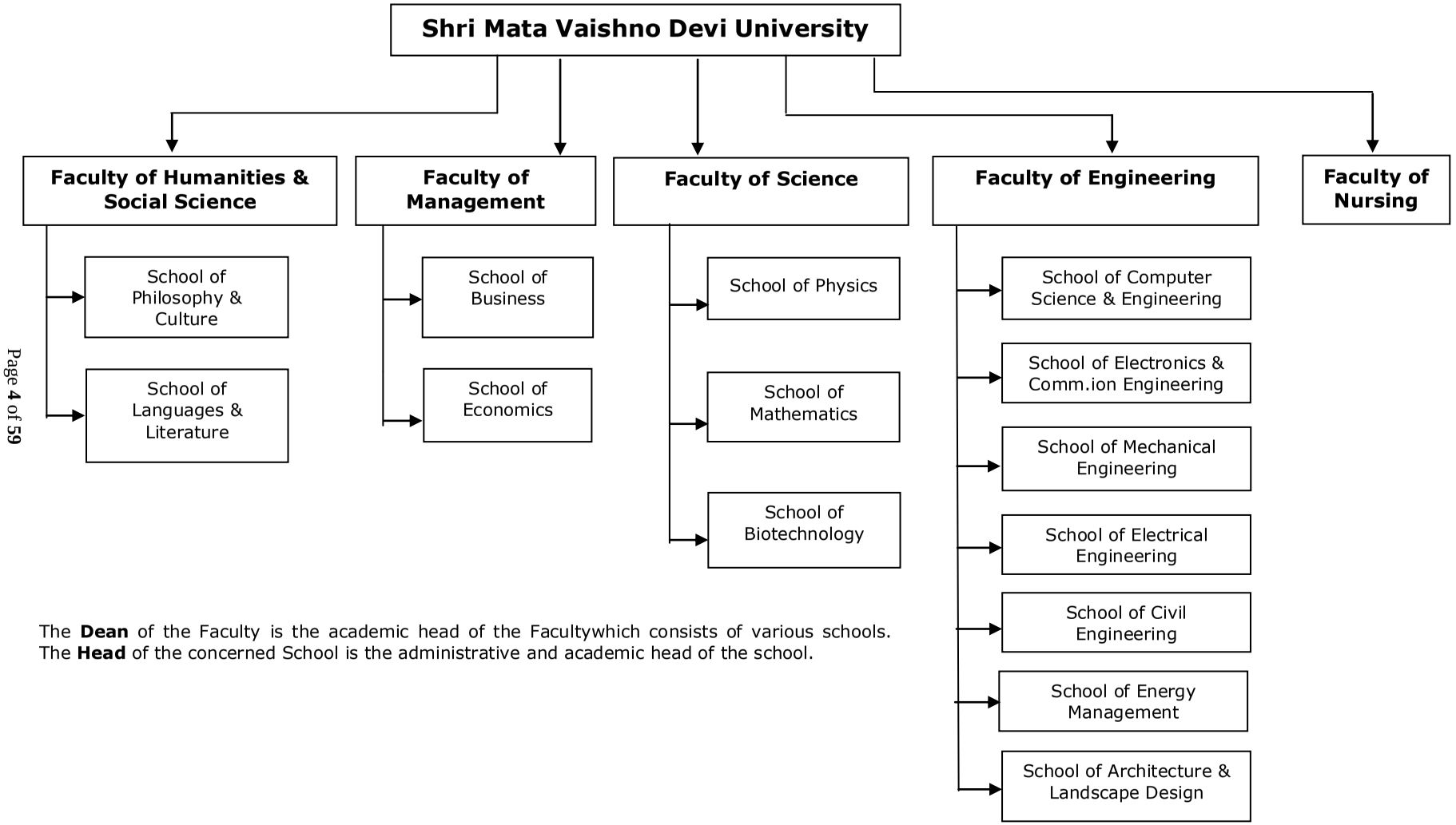
Post-graduate Programs

1. Master of Business Administration
2. Master of Technology (Manufacturing & Automation)
3. Master of Technology (Computer Science& Engineering)
4. Master of Technology (Electronics & Communication Engineering)
5. Master of Technology (Energy Management) (Part-Time Program)
6. Master of Arts (Philosophy)
7. Master of Arts (English)
8. Master of Sciences (Mathematics)
9. Master of Sciences (Physics)
10. Master of Sciences (Biotechnology)

PhD Programmes

3.0 Academic System, Rules & Regulations

Academic Structure of the University



The **Dean** of the Faculty is the academic head of the Facultywhich consists of various schools. The **Head** of the concerned School is the administrative and academic head of the school.

Vision of the School
To provide quality human resource equipped with technical expertise in Computer Science and Engineering to the world that are competent in solving the problems in industry and society and have high moral and ethical values.

Mission of the School
- To have a program and value system appropriate to the pursuit of Computer Science and Engineering to meet the needs of the society.
- To nurture the students with proficiency in Computer Science and Engineering, and inculcate versatility of mind, motivation for learning and building self-reliance.

POs & PEOs of Programs

Program Outcomes:

The curriculum and syllabi of B. Tech. Four Year Full Time Degree Program is designed to achieve identified Graduate Attributes (GAs) with following POs.

1. Ability to apply the knowledge of mathematics, science, engineering, computing in practice.
2. An ability to identify, critically analyze, formulate and solve computational problems
3. An ability to select appropriate engineering tools and techniques and use them comprehensively
4. Ability to design and conduct research based experiments, perform analysis and interpretation of data and provide valid conclusions.
5. Ability to use current techniques, skills, and IT tools necessary for computing practice.
6. Understanding of ethical, legal, health, security, multi-cultural and social issues, and the consequent responsibilities relevant to the professional engineering practice.
7. Understanding the impact of environment and propose the technological solutions for sustainable development.
8. Practice ethical principles and oblige to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a team member or team leader in diverse environments.
10. Ability to communicate effectively, using different modes of communication and write technical reports and publications effectively.
11. Ability to have adaptation towards learning new technologies, and develop an approach for their effective usage throughout the life.
12. Understanding different principals of management and develop an ability to apply in software industry.

PROGRAM EDUCATIONAL OBJECTIVES

- **PEO 1**: To prepare students with advanced knowledge of engineering and technology so as to keep abreast of the current trends in the field of computer engineering.
- **PEO 2:** To prepare students to become successful professionals in industry, government, entrepreneurial pursuit and consulting firms.
- **PEO 3:** To prepare students having skills to function as members of multi-disciplinary teams and to communicate effectively using modern tools.

Details of Programs Offered
The school currently offers a 4 year (8 semesters) B.Tech programme in Computer Science & Engineering, a 2year (4Semesters) M.Tech Programme in Computer Science & Engineering and Ph.D.

The purpose of programmes are:

- To have a perception and a value system appropriate to the pursuit of high science and high engineering science to meet the critically evaluated needs of the society in terms if products and processes using indigenous resources
- To develop in each student mastery of fundamentals , versatility of mind , motivation for learning, intellectual discipline and self-reliance which provide the best foundation for continuing professional achievement;
- To provide a liberal; as well as a professional education so that each student acquires a respect for moral values, a sense of their duties as a citizen , a feeling for taste and style ,and a better human understanding. All these are required for leadership;
- To send forth men and women of the highest professional competence with a breath of learning and a character to deal constructively with issues, and problems anticipated in the next decade relevant to the Programmes of development of our country.

Details of Minor & Interdisciplinary Specialization Offered (if any)

Pedagogy
The emphasis of the program is on practical, hands-on learning. Significant part of the curriculum is dedicated to ensuring that the students get to work with latest equipment and explore the implementation of the knowledge learnt through the class-work. The students arealso required to undergo summer training in an industrial environment to learn industrial standards of project management, teamwork, quality considerations and documentation.

Infrastructure
The School of Computer Science & Engineering at Shri Mata Vaishno Devi University prides itself on its state-of-the-art laboratories, each equipped with the latest computer systems interconnected in a network. This advanced setup offers students a comprehensive platform to delve deep into the intricate concepts of computer science, fostering a seamless integration of theory learned in the classroom with practical applications.

The School currently has the following laboratories:

1. PROJECT LAB
2. DATABASE LAB
3. INTERNET LAB
4. PROGRAMMING LAB
5. OPERATING SYSTEM LAB
6. BASIC COMPUTING LABORATORY

Name of the Laboratory	**System Specification**	**Purpose**
Programming Lab	System Model – DELL OPTIPLEX 330 RAM – 2GB Processor - Intel ® Pentium ® Dual core @ 1.60GHZ HDD - 160GB No of Systems – 30 1 APC UPS	Programming lab is used to inculcate programming skills among the students. This lab is helping students to specialize in their concerned subjects. This programming lab is utilized by UG and PG students. This lab is scheduled for students according to time table and they are able to learn program solving technique. This lab is meant for conducting labs mainly for programming languages like C, C++, DAA, soft computing etc. This programming Lab helps placement cell to conduct online exam for students during placement drive. This

		Lab is well established and fully equipped with DELL Optiplex .There are 30 systems in lab
Internet Lab	Computer Systems: 71 Projector: 1 Speakers: 2 UPS (20 KVA): 1 Access Point: 1 White Board: 1 Air Conditioner: 4 C, C++, Python Compliers loaded. R Studio	Internet lab is one of the largest computer lab of the University with 70 Dell Optiplex computers. All computers are connected with the Internet provided by NKN. It is also equipped with projector and online UPS of 12KVA. Internet lab is used for various online exams for the purpose of placement, recruitment, admission. It is also used for training and workshops. Students regular lab classes for programming languages such as C, Python, R Programming, Data structures etc. conducted in this lab.
Database Lab	Model: HP Elite Desk G2 800 SFF Processor: Intel core i7 CPU @ 3.4 GHz RAM: 16 GB HDD: 1 TB	This lab is extensively used by the students for exploring each and every aspect of Database Management System (DBMS). This lab consists of the open source software's like Visual Studio Code, Netbeans 8.0 IDE, JDK Kit, Mysql, Dev C++, Code Blocks, Anaconda 3 bundle, online tools to conduct experiments related to software engineering. The students are provided hands on training in the areas of Database Management System (DBMS) Lab, Data Structure Lab, Python lab, DAA Lab, Machine learning Lab, and Software engineering Lab etc. The Lab is equipped with 30 HP computers of latest configuration and has its own separate virtual LAN .
Linux Lab	System Model – Dell Optiplex 5050: 28Processor – Intel Core i7 @ 3.66 Ghz RAM – 16 GB HDD – 1 TB Projector- Hitachi Operating System : Windows 10 (Licensed) and Ubuntu through Virtual Box (Open source) Softwares:MS Office (Licensed) : Dev C++ (Freeware), Oracle Virtual Box (Freeware), Python , Anaconda/Spydar (Freeware) , Python IDLE (Freeware), Code Blocks (Freeware)	Linux lab is equipped with 32 computer systems, networked through CISCO network switch. This lab is used for conducting labs for various Programs offered by the School. The lab is facilitated with Projector to facilitate the ICT mode of teaching. The online APC 5 KVA UPS is installed in the lab for back up. Different lab schedules are followed during different semesters in a year with a load of 14-16 Hrs per week of lab utilization load. Lab achieves the objective of introduction of Linux/ Ubuntu kernel programming techniques and advanced C system programming and debugging techniques in Linux/ Ubuntu environment. The lab also utilized for conducting practical sessions of Programming with C, Data structure, Python, Machine learning and Deep learning.
Basic Computing Lab	Computer Systems:,	There are currently thirty one computers in

	DELL Optiplex 330 & 980- 31	the lab loaded with Windows operating system. Basic Computing lab offer the campus community access to computing resources and a variety of software in support of learning, scholarship and creative endeavor at SMVDU. Computers in the lab are used to for developing programming skills, help share assignments, enhance or expand lessons and increase knowledge. Computers and software are upgraded on a regular basis, as per the syllabus requirement.
Project Lab	System (20+1 Nos) = 21 PO : SMVDU/S&P/2016-16/3039-43 Projector (Sharp)-1 Printer (HP) UPS (APC)-1	Project Laboratory of School of Computer Science & Engineering has been set up to maintain a wide variety of state-of-the-art computing facilities for research and training of the highest standards for the Research Scholars and students. Project Laboratory helps students in versatility of their minds, motivation for learning new technologies, intellectual discipline and self-reliance. General-purpose research computing is provided by over 20 Windows / Unix-based workstations having Processor configuration Intel (R) core (TM) i5-4570 CPU@ 3.20Hz , Installed memory : 16.0 GB, HDD : 500 GB , located in laboratories with installed software like METLAB -R2017B, Net Sim , AEM

Details of Programme of Study & Syllabus of Courses Offered by School of Computer Science and Engineering

Course Structure of
B. Tech (Computer Science & Engineering)programme, Batch 2020-2024

Semester 1

Course Code	Course Title	L	T	P	C
MTL 1025	Engineering Mathematics-I	3	0	0	3
ECL 1010	Basic Electronics	3	0	0	3
ECP 1010	Basic Electronics Lab	0	0	2	1
PHL 1012	Engineering Physics	3	0	0	3
PHP 1012	Engineering Physics Lab	0	0	2	1
CSL 1022	Introduction to 'C' Programming	3	0	0	3
CSP 1022	'C' Programming Lab	0	0	2	1
LNL 1411	Professional Communication	2	0	0	2
LNP 1411	Professional Communication Lab	0	0	2	1
MEL 1039	Engineering Grpahics with CAD	1	0	2	2
CSL 1001	Introduction to Computer Sc. & Engineering	1	0	0	NC
	Induction Program				NC
PCN 1010	NSS				NC
	Total Credits				**20**

Semester 2

Course Code	Course Title	L	T	P	C
CSL 2031	Data Structures	3	0	0	3
CSP 2031	Data Structures Lab	0	0	2	1
CSL 1028	Programming using Python	2	0	0	2
CSP 1028	Python Programming Lab	0	0	4	2
ECL 2070	Digital Electronics	3	0	0	3
ECP 2070	Digital Electronics Lab	0	0	2	1
MTL 1026	Engineering Mathematics II	3	0	0	3
PCL 1067	Discourse on Human Virtues	3	0	0	3
MEP 1114	Workshop	0	0	2	1
MTL 2024	Discrete Structures	3	0	0	3
LNP 1142	Language Lab	0	0	2	1
	Total Credits				**23**

Semester 3

Course Code	Course Title	L	T	P	C
PCL 2042	Introduction to Logic	3	0	0	3
CSL 2041	Theory of Computation	3	1	0	4
CSL 2061	Computer Organization & Architecture	3	1	0	4
CSL 2022	Object Oriented Programming	3	0	0	3
CSP 2022	Object Oriented Programming Lab	0	0	2	1
CSL 2051	Operating Systems	3	0	0	3
CSP 2051	Operating Systems Lab	0	0	2	1
CSC 2001	Summer internship-I				1
BTL 2304	Environmental Studies	3	0	0	NC
	Total Credits				**20**

Semester 4

Course Code	Course Title	L	T	P	C
	Open Elective-I	3	0	0	3
CSL 3071	Computer Network & Communications	3	0	0	3
CSP 3071	Computer Network & Communications Lab	0	0	2	1
CSL 3032	Design & Algorithm Analysis	3	0	0	3
CSP 3032	Design & Algorithm Analysis Lab	0	0	2	1
CSL 3081	Database Management Systems	3	0	0	3
CSP 3081	Database Management Systems Lab	0	0	2	1
ECL 2060	Microprocessors & Interfacing	3	0	0	3
ECP 2060	Microprocessors & Interfacing Lab	0	0	2	1
	Total Credits				**19**

Semester 5

Course Code	Course Title	L	T	P	C
	School Elective-I	3	0	0	3
	Open Elective-II	3	0	0	3
CSL 4053	Compiler Design	3	1	0	4
CSL 3023	Java Programming	3	0	0	3
CSP 3023	Java Programming Lab	0	0	2	1
CSL 3101	Artificial Intelligence	3	1	0	4
CSD 3001	Mini Project –I				3
CSC 3001	Summer Internship-II				1
PCN 3079	Constitution of India	1	0	0	NC
	Total Credits				**22**

Semester 6

Course Code	Course Title	L	T	P	C
CSE XXXX	School Elective-II	3	0	0	3
CSE XXXX	School Elective-III	3	0	0	3
CSL 4107	Machine Learning	3	0	0	3
CSP 4107	Machine Learning Lab	0	0	2	1
CSL 3035	Soft Computing	3	0	0	3
CSP 3035	Soft Computing Lab	0	0	2	1
CSL 3091	Software Engineering	3	0	0	3
CSP 3091	Software Engineering Lab	0	0	2	1
CSL 4121	Computer Network Security	3	0	0	3
CSD 3002	Mini Project –II				3
	Total Credits				**24**

Clearing Comprehensive Exam is mandatory for award of degree and the exam will be held multiple times after completion of semester Six.

Semester 7

Course Code	Course Title	L	T	P	C
CSC 4002	Summer Internship - III				2

	School Elective –IV	3	0	0	3
	School Elective-V	3	0	0	3
CSL 4144	**Nature Inspired Algorithms**	3	0	0	3
CSL 4091	Digital Image Processing	3	0	0	3
CSP 4091	Digital Image Processing Lab	0	0	2	1
BUL 4011	Entrepreneurship Management	3	0	0	3
CSD 4002	Mini Project				4
	Total Credits				**22**

Semester 8

Course Code	Course Title	L	T	P	C
CSD 4100/CSC 4083	[Major Project + **Open Elective-III-(NC)**] / Internship				**10**
	Total Credits				**10**

Total Credits: 160

Minimum Total Credits to be earned in order to become eligible for award of B. Tech. (Four Year Full Time) Degree: 160

List of Electives

LIST OF PROGRAM ELECTIVES (Theory Based)						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
School Elective – I						
1.	**CSE 3028**	**Software Defined Networking**	**2**	**0**	2	**3**
2.	CSE 3072	Storage Networks	3	0	0	3
3.	CSE4102	Neural Networks & Fuzzy Set	3	0	0	3
4.	CSE 3082	Data mining & warehousing	3	0	0	3
5.	CSL 3583/CSE 3583	Blockchain Coding	3	0	0	3
School Elective – II						
1	CSE4152	Cloud Computing	3	0	0	3
2	CSE4151	Parallel & Distributed Computing	3	0	0	3
3	CSE 6036	Deep Learning	3	0	0	3
4	CSE4062	Advanced Computer Architecture	3	0	0	3
School Elective – III						
1.	CSE 3109	Internet of Things	3	0	0	3
2.	CSE 4142	Human Computer Interaction	3	0	0	3
3.	CSE 3080	Quantum Computing	3	0	2	4
School Elective – IV						
1	CSE3074	Wireless Networks	3	0	0	3
2	CSE 4012	Information Coding Practices	3	0	0	3
3	CSE 4054	Computer Embedded Systems	3	0	0	3
4	CSE4090	Multimedia and Virtual Reality	3	0	0	3
School Elective – V						
1	**CSE 4223**	**High Performance Computing**	**3**	**0**	**0**	**3**
2	CSE 3122	Cyber Security	3	0	0	3
3	CSE 4016	E-Commerce & Cyber Laws	3	0	0	3
4	CSE 4017	Digital Forensic	3	0	0	3
5	CSE 4044	Robotics & Vision Control	3	0	0	3

Engineering Mathematics-I

MTL 1025 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Introduce the basic concept of differential calculus to understand the different subjects of

	engineering as well as basic sciences.
CO2	Enable the students to develop the concept of partial differentiation to understand their applications in engineering
CO3	Understand the fundamentals of Integral calculus to understand their applications to length, area, volume, surface of revolution, moments and centre of gravity
CO4	Understand the improper integrals and Beta and Gamma functions and their applications
CO5	Understand the idea of Linear Algebra which are useful to all branches of engineering.

Course Contents

UNIT-I

Differential Calculus: Partial Differentiation, asymptotes, concavity, convexity, point of inflexion, curvature, radius of curvature, curve tracing, envelopes and evolutes, change of variables, Jacobian, expansion of functions of several variables, chain rule, mean value theorem, Taylor series with remainder term, maxima & minima, saddle point.

UNIT-II

Integral Calculus: Fundamental theorem of Integral calculus, reduction formulae, properties of definite integral, applications to length, area, volume, surface of revolution. Moments, centre of gravity, improper integrals, β-γ functions.

UNIT-III

Matrices: Elementary row and column transformation, linear dependence, rank of a matrix, consistency of system of linear equations, solution of linear system of equations, characteristic equations, Cayley Hamilton theorem, eigen values and eigen vectors, diagonalization, complex matrices.

Reference Books:

- E. Kreysig , Advanced Engineering Mathematics , Wiley 10th Edition, 2011
- A . K. Gupta , Engineering Mathematics, Macmillan 7th Edition 2013
- McQuarri Macmillan, Mathematical Methods by Scientists & Engineers, 1st Edition 2013
- Shanti Narayan, Differential Calculus, S. Chand; 30th Revised edition, 2005

Basic Electronics

ECL 1010 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Electronic Circuits and applications of semiconductor diodes
CO2	Theory and electronic circuit design of Bipolar Junction Transistors
CO3	Describe DC load line and bias point. List, explain, and design and analyze the different biasing circuits, introducing h-parameters
CO4	Theory, structure of Field Effect Transistor. Explain the operation of each type of this device
CO5	Sketch, explain the oscillator, discuss the principles, and oscillator types

Course Contents

Introduction:- Semiconductor Classification ,Semiconductor bonds, Energy band description ,Semiconductor types, Hall effect.

Diodes:- P-N junction-I/V characteristics, diode equivalent circuits, semiconductor diodes, rectifiers-(efficiency, ripple factor),filters,clipers,clampers.

Transistors:- BJT construction, characteristics (cb,ce,cc), load line. BJT biasing. FET, JFET, MOSFET (Depletion and enhancement), FET biasing.

Transistor Modeling:- BJT small signal model, hybrid equivalent model,FET small signal model.

Amplifiers:- Single stage amplifiers, voltage gain, effect of frequency on Gain, multistage amplifier.

Other Semi-conductor devices- SCR'S , Diacs, triacs, and other thyristors, basic theory of operation, characteristics, Theory and operation of UJT,

Oscillators:- Feedback BH criteria, oscillator types, sinusoidal oscillator, Hartley oscillator,Collpitts Oscillator, Phase shift,Wein bridge oscillator, crystal oscillator.

Reference Books:

- Basic Electronics: Devices, Circuits & IT Fundamentals, Kal, PHI
- Basic Electronics for Scientists
- Electronic Devices & Circuits: An Introduction, Mottershead,
- Electronic Devices & Circuits, Boylestad, Nashelky, PHI
- Semiconductor Devices , NanditaDass, PHI
- Electronic Devices & Circuits, Milman&Halkias
- Electronic Devices & Circuits, Theodore Bogart, Jr

Basic Electronics Lab

ECP 1010 **0 – 0 – 2 = 1**

List of Experiments:

1. To study the front panel control of Multimeter
2. To study the front panel control of DC Multiple Power Supply
3. To study the front panel control of Cathode Ray Oscilloscope (CRO)
4. To study the front panel control of Function Generator

5. To determine and plot the operating characteristics of a PN junction diode
6. To study the characteristics of Zener Diode and its application as voltage regulator
7. To study the input / output waveforms of Half-wave rectifier using diode and find out its ripple factor and efficiency
8. To study the input / output waveform of Full-wave Bridge rectifier using diodes and find out its ripple factor and efficiency
9. To study different Clipper circuits using PN junction diode for both positive and negative configurations
10. To study different Clamper circuits using PN junction diode
11. To plot and determine the characteristics of common-emitter configuration of a transistor
12. To plot and determine the characteristics of common-base configuration of a transistor

Engineering Physics

PHL 1012 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Know the vocabulary and concepts of Physics as it applies to: Electricity and Magnetism and Modern Physics.
CO2	Develop the mathematical description of these concepts and principles to build up problem solving skills that will benefit their future career.
CO3	Apply an understanding of these concepts to develop various modern systems, structures, technology and devices.
CO4	Gain confidence to apply mathematical methods to understand Physics problems in real-life situations.

Course Contents

UNIT I: Force and electric field due to continuous charge distribution, Field lines-Electric Flux, Gauss's Law (differential and integral forms), Applications of Gauss's law Electric potential, work done in assembling a charge distribution

UNIT II: Force Law - line current, surface current and volume current densities (Equation of continuity), Biot-savart law, Properties of B, Magnetic flux-Divergence B, Curl B, magnetic vector potential A Ampere's law (differential and integral forms), displacement current, modified Ampere's law Faraday's laws of electromagnetic induction, Four Maxwell's equations in differential and integral forms

UNIT III: Electromagnetic Spectrum, brief introduction to black body radiation, photo-electric Effect, Compton Effect, wave particle duality (de-Broglie waves), Davisson-Germer Experiment, concept of wave function and its physical significance, Phase and group velocities, Uncertainty principle.

UNIT IV : Bohr theory of atom (with finite and infinite nuclear mass) Derivarion of time dependent and time independent Schrödinger wave equations, Expectation values and operators (momentum, energy and angular momentum operators), Commutators, Particle in a box of infinite height (One dimensional),

UNIT V: Free electron theory-Free electron gas, Energy levels and density of states in one dimension Band theory of solids, Classification of metals, semiconductors and insulators on the basis of band theory

Reference Books:

1. Introduction to Electrodynamics, D. J. Griffiths, Pearson.
2. Electromagnetics, B. B. Laud, New Age International Publisher.
3. Concepts of Modern Physics, Arthur Beiser, Tata McGraw Hills
4. Introduction to Solid State Physics, Charles Kittel, Wiley
5. Solid State Physics, S.O. Pillai, Wiley
6. Fundamentals of Physics, Resnick Halliday, Wiley

Engineering Physics Lab

PHP 1012 **0 – 0 – 2 = 1**

List of Experiments:

1. To study the Measuring Instruments (Vernier Calipers, Screw Gauge &Spherometer)
2. To find the angle of prism by rotating the telescope method.
3. To find the refractive index of the material of the given prism using a spectrometer.
4. To determine the refractive index of the given liquid (water) using a hallow prism and spectrometer.
5. To study the Newton's Interference Rings and to determine the wavelength of Sodium light.
6. To determine the Wave Length of Sodium Light using a plane diffraction grating.
7. To determine the frequency of A.C. mains with a Sonometer using non magnetic wire.
8. To draw the characteristics curves of a Semiconductor Diodes (Si or Ge).
9. To study the V-I characteristics of a Zener Diode.
10. To study the performance of a Half-wave, Full-wave & Bridge wave rectifier without filters.
11. To verify Stefan's law by estimating the temperature of a torch bulb filament from resistance measurement.
12. To study the Hall Effect and to calculate the Hall Coefficient and Charge Carrier Concentration of a given sample.
13. To study the dependence of Refractive Index(μ) of the material of the prism on the Wavelength(λ) of light; and hence(1) to determine the Dispersive Power of the material of prism;(2)to verify the Cauchy Relationship $\mu=a+b/\lambda^2$,and to estimate the values of a & b(3)to plot a graph of $d\mu/d\lambda$ versus λ.
14. To determine the band gap by measuring the resistance of a Thermistor at different temperatures.

15. To determine the energy band gap of a semiconductor diode (Ge) using Four Probe Method.
16. To study the wavelength of He-Ne Laser.

Introduction to 'C' Programming

CSL 1022 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Knowledge and understanding of programming.
CO2	Ability to write simple programs in C language by using basic control structures (conditional statements, loops, switches, branching, etc.).
CO3	Understanding the concept of programming using functions, arrays, strings, pointers and structures, and implement the various operations on them.
CO4	Ability to create a programmable model for a problem given.

Course Contents

Introduction: Concept of problem solving, Problem definition, Program design, Techniques of Problem Solving (Flowcharting, algorithms, pseudo code), Structured programming concepts

Fundamentals: C character set, Tokens, identifiers and keywords, constants and variables, Data types, Data Type Modifiers Structure of a C Program, , Types of Statements: declarations, arithmetic statements and arithmetic operations, , Operators: Arithmetic, relational and equality, logical, assignment and compound assignment, Operators classification based on number of operands: Unary, Binary and Ternary (conditional, unary operations), operator's precedence & associativity, library functions, single character input and output, entering and writing data.

Control Statements: Statement and blocks, Decision making structures: if else and its types, Looping structures: while, for, do while, Case control structures: switch, break and continue statements, nested control structures.

Arrays: Definition, types, initialization, processing an array, 2 Dimension Arrays, Sorting, Searching, Copy, Insertion, Deletion of elements in array.

Functions and pointers: Functions definition, prototype, passing parameters, recursion, pointers, pointers and arrays, pointers and Functions,

String: Operations onString, built in functions, string and functions

User defined data types and Additional Features of C: Structures, Array of Structures, Array within Structures, Structures within Structures, Union, Enumerations, Pre-processor Directives

Reference Books:

1. Gottfried, Byron S., "Programming with C", Tata McGraw Hill
2. Balagurusamy, E., "ANSI C", Tata McGraw-Hill
3. YashwantKanetker, "Let us C", BPB
4. C, The Complete Reference, Scholdt, TMH
5. Programming with C, S. Kaicher, Macmillan
6. C For Yourself, Asian Inst. of Tech AIT
7. Structured Programming Approach Using C, B. Forouzen, Thomas Learning

'C' Programming Lab

CSP 1022 **0 – 0 – 2 = 1**

List of experiments :

1. Write a program to know the number of bytes of data type contains
2. Write a program to display the ASCII code of a variable on the screen
3. Write a program to find the sum of digits of a 4 digit number
4. Write a program to reverse a 4 digit number
5. Write a program to swap the values of two variables with/without using third variable
6. Write a program to display if a number is even or odd
7. Write a program to display that a person is eligible for voting
8. Write a program to display greatest among two/ three numbers
9. Write a program to read number between 1-7 & display corresponding day of week
10. Write a program to read marks of five subjects and compute percentage and display grade of students based on percentage
11. Write a program to check whether the year entered is leap year or not
12. Write a program to print the relation between 2 numbers as equal to, less than or greater than
13. Write a program to read lower case character and display it in upper case
14. Write a program to convert Celsius into Fahrenheit
15. Write a program to swap the values to two variables with the help of temporary variable
16. Write a program to make a calculator
17. Write a program to print 1 to 10 in ascending and descending order on screen
18. Write a program to print sum of all even/ odd numbers between 1 to n
19. Write a program to print multiplication table of n
20. Write a program to find factorial of a number
21. Write a program to find sum of all numbers between m to n
22. Write a program to read a number and print each digit on separate line
23. Write a program to find the sum of digits of a number
24. Write a program to reverse a number

25. Write a program to find if the number is Palindrome or not
26. Write a program to read +ve numbers from user till user enters 0 & display for each number whether it is even or odd
27. Write a program to read character from user till user enters special character and display count of vowels and digits
28. Write a program to print all leap years between year m to n
29. Write a program to read a number and find if it is an Armstrong number or not
30. Write a program to print all prime number between n to m
31. Write a program using switch case to read one number and perform 1. Sum of digit 2. Reverse of number 3. Number is palindrome or not
32. Write a program using switch case to read operator and perform (+, -, /, *) operators of operands
33. Write a program to sort an array of type integer
34. Write a program to reverse an array element in the array
35. Write a program to check if the array is palindrome or not
36. Write a program to insert an element in sorted array at its right place
37. Write a program to delete all the duplicate numbers from the array
38. Write a program to read temperature recorded for the month of September. Display the highest and lowest temperature recorded
39. Write a program to read total marks of 90 students. Find the average marks scored by the class. Display the number of students having marks below average and total number of students marks equal to or above average.
40. Write a program to read n numbers in an array. Display the count of total –ve numbers, +ve numbers and total zero. Your program must derive m which should be added to all –ve numbers so as they are converted to either zero or +ve number.
41. Write a program to sum the two arrays into another array.
42. Write a program to add two matrix using multi-dimensional arrays
43. Write a program to multiply to matrix using multi-dimensional arrays
44. Write a program to find transpose of a matrix
45. Write a program to find the length of a string
46. Write a program to find the total number of vowels in the string
47. Write a program to find the number of vowels, consonants, digits and white space in string using Switch - case
48. Write a program to concatenate two strings
49. Write a program to find the total number of words in a sentence
50. Write a program to reverse a sentence
51. Write a program to remove all characters in a string except alphabet
52. Write a program to sort elements in different orders in string
53. Write a program to insert a character in a string
54. Write a program to delete a character in a string
55. Write a program to insert a word in a string
56. Write a program to search a word in a string
57. Write a program to delete a word in a string
58. Write a program to find the length of each string in a 2-dimensional array
59. Write a program to find sort each string in a 2-dimensional array
60. Write a program to display prime numbers between intervals using function
61. Write a program to check prime or Armstrong number using user-defined function
62. Write a program to check whether a number can be expressed as sum of two prime numbers using function
63. Write a program to find the sum of n natural numbers using function
64. Write a program to calculate factorial of a number using function
65. Write a program to reverse a sentence using function
66. Write a program to calculate power of a number using function
67. Write a program to convert binary number to decimal and vice-versa using function
68. Write a program to store information (name, roll and marks) of student using structure
69. Write a program to add two distances (in inch-feet) system using structure
70. Write a program to add two complex numbers by passing structure to a function
71. Write a program to calculate between two time period using structures and functions
72. Write a program to store information of 10 students using structure and display the roll no, name and total marks of each student structures and functions
73. Write a program to swap numbers of an array using call by reference
74. Write a program to find largest number in an array using function
75. Write a program to multiply two matrices by passing matrix to function

Professional Communication

LNL 1411 **2 – 0 –0= 2**

Course Outcomes

CO1	Have an advance knowledge about communication skills, their evolving nature and how to use them effectively.
CO2	Use knowledge of technology and can use it to communicate effectively in various settings and contexts.
CO3	Communicate appropriately and effectively within various organizations, also with global audience

	in a constantly changing technological ambience and demonstrate the ability to analyze a problem and devise a solution.
CO4	Employ skills that are necessary for career development and also to demonstrate an ability to work with a variety of personality types.
CO5	Deliver effectively formal and informal oral presentations to a variety of audiences in multiple contexts.
CO6	Contribute ethically, responsibly, and effectively as local, national, international, and global citizen and leader.

Course Contents:

Unit 1: General Communication

Purpose of Communication; Process of Communication; Importance of Communication; The Seven C's of the Effective Communication; Differences between Technical and General Communication. Barriers to Communication and Measures to Overcome the Barriers to Communication; Scope and Types of Communication Network; Formal and Informal Communication Network; Upward Communication; Downward Communication; Horizontal Communication; Diagonal Communication

Unit 2: Written Communication

Email: How to write a Formal E-mail

Letter Writing Cover Letter: Format of Letter Writing: Block and Modified, etc. ; Formal and Informal Letter Writing; Formal Letter Formats

Note Making and Notice Writing: Purpose; Format; Points to remember while writing a Note and Notice. Minutes and Agendas: Difference between Minutes and Agendas; Purpose; Format; Points to remember while drafting Minutes and Agendas

Unit 3: Job Application

Resume and CVs: Contents of Good Resume; Guidelines for Writing Resume; Different Types of Resumes; Difference between CVs and Resume

Cover Letter; Reason for a Cover Letter to Apply for a Job-Format of Cover Letter; Different Types of Cover Letters

Unit 4: Report Writing

Technical Report Writing: Difference between Business Report and Engineering Report; Characteristics of writing a good report; Guidelines for Report Writing; Steps in Report Writing; Structure of Report; Types of Reports and Different Formats.

Reference Books:

1. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, 2015.
2. Choudhury, Soumitra, and AnjanaNeira Dev. *Business English.* Pearson Publication, 2008.
3. Mukerjee, Hory S. *Business Communication*. New Delhi: Oxford University Press, 2013.
4. Williams, D. *Communication Skills in Practice: A Practical Guide for Health Professionals*. London, United Kingdom: J.Kingsley, 2007.
5. Pandey, O. N. *Technical Writing*. New Delhi: S.K. Kataria& Sons, 2014.

Professional Communication Lab

LNP 1411 **0 – 0 –2= 1**

Unit 1

Oral Communication

Speaking Skills: Kinds of Speaking Skills, Effective ways of Speaking, Public Speaking

Listening Skills: Stages of Listening Process, Strategies of Listening, Types of Listening

Professional Speaking: Interview Process, Characteristics of Job Interview, Pre Interview Preparation Techniques, Answering Strategies, Frequently asked Interview questions, Projecting a positive image and Body Language

Group Discussion: Definition, Methodology of Group Discussion, Techniques for Individual Contribution, Group Interaction Strategies, Helpful Expression and Evaluation, Practical Sessions

Unit 2

Reading Skills

Enriching Language through Literature; Comprehension

Enhancing Vocabulary: Antonyms and Synonyms, Phrasal Verbs, One word Substitution, Homophones, Common Errors, Figure of Speech: Metaphor, Personification, Simile, Alliteration, Assonance, Paradox, Imagery, Oxymoron, Onomatopoeia.

Suggested Readings:

1. Choudhury, Soumitra, and AnjanaNeira Dev. *Business English.* Pearson Publication, 2008.
2. Mukerjee, Hory S. *Business Communication*. New Delhi: Oxford University Press, 2013.
3. Williams, D. *Communication Skills in Practice: A Practical Guide for Health Professionals*. London, United Kingdom: J.Kingsley, 2007.
4. Pandey, O. N. *Technical Writing*. New Delhi: S.K. Kataria& Sons, 2014.

Engineering Graphics with CAD

MEL 1039 **1 – 0 – 2 = 2**

Course Outcomes

CO1	To learn basics of drawing including dimensioning.
CO2	To draw orthographic projections of points and lines and traces of line.
CO3	To draw orthographic projections of planes.
CO$	To draw orthographic projections and section of solids.

Course Contents:

Section-A

Introduction of Engineering Graphics: Drawing instruments and their uses, Orthographic Projections: Planes of projection – Projection of points in different quadrants. Orthographic Projection of Straight Line parallel to one plane and inclined to the other plane – Straight Line inclined to both the planes – True Length and inclination of lines with reference planes – Traces of line – Projection of Planes, Projection of Solids.

Section of Solids: Classification of Solids, Section plane perpendicular to one plane and parallel to other, Section plane inclined to one plane and perpendicular to other plane.

Development of Surfaces: Principle, Engineering applications and Methods of development.

Section-B

Introduction to AutoCAD: Starting AutoCAD, AutoCAD screen components, creating a drawing on AutoCAD, invoking different commands, Dialog boxes, Coordinate Systems, Exercises on Drawing of Line, Circle, Arc, Ellipse, Polygon, etc.

Drawing Aids and Editing Commands: Layers, Drafting Settings, Object Snaps, Function and Control keys, various Editing Commands, Editing the Objects with Grips, Grip Types.

Creating Text, Dimensions and Tolerances in AutoCAD: Creating Text, Editing Text, Styles of Dimensioning, Dimensioning System Variables, Editing/Updating Dimensions, Adding Tolerances.

Reference Books:

1. Bhat, N.D. and Panchal, V. M. - Engineering Drawing, Charotar Publishers, Anand.
2. Narayana, K.L. and Kannaiah, P.- Engineering Graphics, Tata Mc Graw Hill, New Delhi.
3. Gill, P.S- Engineering Drawing, S.K Kataria& Sons, New Delhi.
4. Ellen Filkensten - AutoCAD & AutoCAD LT Bible,Wiley, New York.
5. Sham Tickoo - AutoCAD ,Tata McGraw Hill, New Delhi.

Introduction to Computer Sc. & Engineering

CSL 1001 **1 – 0 – 0=NC**

Course Outcomes

CO1	The student should able to learn recent related areas to computer engineering.
CO2	The student should able to learn the history and recent development related to the different field of computer engineering.
CO3	The student should able to learn the development and future prospect related to the field of computer science and engineering.

Course Contents:

This course covers fundamental areas of computer science & engineering. The descriptions are as follows:

1. Programming Languages
   - Functional programming languages
   - Objected oriented programming
2. Algorithm & Data Structures
3. Compiler and Automata
4. Operating System and Computer networks
5. Databases and Servers
6. Image Processing
7. Artificial Intelligence & Machine Learning
8. Soft Computing and Deep Learning
9. Big Data and Data Science
10. Wireless and Sensor Networks
11. Internet of Things & Block Chain Technology
12. Neural Networks & Genetic Algorithms

Data Structures

CSL 2031 **3 – 0– 0 = 3**

Course Outcomes

CO1	Select appropriate data structure as applied to specified problem definition.
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues.
CO3	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data

CO4	Demonstrate a thorough understanding of how data structures impact the performance of algorithms.

Course Contents:

Unit-1: INTRODUCTION (5 Contact Periods)

Introduction to programming methodologies and design of algorithms, Structured programming concepts, Study and implementation of basic data structures like: Arrays, multidimensional arrays and their organization, introduction to sparse arrays

Unit-2: LINKED LIST (6 Contact Periods)

Linked list (singly, doubly and circular),Concept of linked list, Difference of link list & array, Single linked list, Representation, Operations, Traversing, Insertion(first node, last node, at a position, after a node value), Deletion(first node, last node, at a position, after a node value), Double linked list, Representation , Operations, traversing, Insertion (first node, last node, at a position, after a node value), Deletion (first node, last node, at a position, after a node value), Circular link list & header link list example

Unit-3: STACKS & QUEUES (8 Contact Periods)

Stacks, Queues, Operations on Stack, Array & Linked Representation, Programs on stack, Push & Pop operations, traversing. Operations on Queue, Array & Linked Representation, Programs on stack, Insert & Delete operations, Circular queue, representation, Deque, Priority Queue, Application of queue

Unit-4: SORTING AND SEARCHING (8 Contact Periods)

Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort

Unit-5 : TREES AND GRAPHS (9 Contact Periods)

Tree terminology, Binary tree, Complete Binary Tree, Binary search tree, Tree Traversals, Creation of Binary Tree from traversal methods, Expression Tree & expression, Manipulation, Binary Search Tree, Insertion & deletion in BST(Program), AVL Tree, M-way Search Tree, B+ tree, Insertion & deletion, Graph:, Graph terminology, Representation of graphs, Path matrix, Graph Traversal, BFS (breadth first search), DFS (depth first search), Minimum spanning Tree, Kruskal's Algorithm & Prim's Algorithm, Warshall's algorithm (shortest path, algorithm)., Introduction to trees and graphs and traversal methods.

Reference Books:

- Data structures, Lipshutiz, Shaum series
- Data structures & program design, R Kurse, PHI
- Data structures: A pseudo code approach with C, R F Gilbarg, Thomson
- An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
- Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International.
- Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed. Fundamentals of Data Structures in C++-By SartajSahani.
- Data Structures: A Pseudo-code approach with C -By Gilberg&Forouzan Publisher Thomson Learning.

Data Structures Lab

CSP 2031 **0 – 0– 2 = 1**

List of Experiments:

1. Design, Develop and Implement a menu driven Program in C for the following Array operations
   a. Creating an Array of N Integer Elements
   b. Display of Array Elements with Suitable Headings
   c. Inserting an Element (ELEM) at a given valid Position (POS)
   d. Deleting an Element at a given valid Position(POS)
   e. Exit.

   Support the program with functions for each of the above operations.

2. Design, Develop and Implement a Program in C for the following operations on Strings
   a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP)
   b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR. Support the program with functions for each of the above operations. Don't use Built-in functions.

3. Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)
   a. Push an Element on to Stack
   b. Pop an Element from Stack
   c. Demonstrate how Stack can be used to check Palindrome
   d. Demonstrate Overflow and Underflow situations on Stack
   e. Display the status of Stack
   f. Exit

   Support the program with appropriate functions for each of the above operations

4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^ (Power) and alphanumeric operands.

5. Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks.

6. Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)
    a. Insert an Element on to Circular QUEUE
    b. Delete an Element from Circular QUEUE
    c. Demonstrate Overflow and Underflow situations on Circular QUEUE
    d. Display the status of Circular QUEUE
    e. Exit

    Support the program with appropriate functions for each of the above operations.

7. Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo
    a. Create a SLL of N Students Data by using front insertion.
    b. Display the status of SLL and count the number of nodes in it
    c. Perform Insertion and Deletion at End of SLL
    d. Perform Insertion and Deletion at Front of SLL
    e. Demonstrate how this SLL can be used as STACK and QUEUE
    f. Exit
8. Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo
    a. Create a DLL of N Employees Data by using end insertion.
    b. Display the status of DLL and count the number of nodes in it
    c. Perform Insertion and Deletion at End of DLL
    d. Perform Insertion and Deletion at Front of DLL
    e. Demonstrate how this DLL can be used as Double Ended Queue
    f. Exit

9. Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes
    a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2y2z-4yz5+3x3yz+2xy5z-2xyz3
    b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z)

    Support the program with appropriate functions for each of the above operations
10. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers
    a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2
    b. Traverse the BST in In order, Preorder and Post Order
    c. Search the BST for a given element (KEY) and report the appropriate message
    d. Delete an element(ELEM) from BST
    Exit

11. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities
    a. Create a Graph of N cities using Adjacency Matrix.
    b. Print all the nodes reachable from a given starting node in a digraph using BFS method
    c. Check whether a given graph is connected or not using DFS method.

12. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K ®L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

Programming using Python

CSL 1028 **2 – 0 – 0 = 2**

Course Outcomes

CO1	Know the basic syntax and Data Structures in Python.
CO2	Think and Design solution in Object Oriented way as well as Procedural way.
CO3	Enjoy coding and compete at online programming sites like CodeChef, HackerEarth etc.

Course Contents:

Unit-1 Introduction

Introduction to importance of IDEs like Spyder (Anaconda)/PyCharm for professional programming, explore Python shell as a calculator and for inputting Python expressions directly, HelloWorld program in

Python script, Python keyword and Identifiers, Indentation, Comments, Data Types in. Operators in Python: comparison, arithmetic, logical, Boolean, bitwise, assignment. Python: numbers, list, tuple, strings, set, dictionary, conversion between various data types

Unit-2 Basic constructs
Input and Output in Python, if-else , for loop, while loop, break, pass, continue, creating Functions, functions with arguments, returning values form functions, lambda expressions, recursion, global and local variables, Importing other modules/packages and using their functions, creating random numbers/random-choice to create programs for simple guessing games like Rock –Paper-Scissors. Problems on 1D/2D/3D arrays using list. Problem solving using dictionary as look-up table.

Unit-3 Object Oriented Programming
Basics of Object oriented programming: Class and Object. Defining variables and functions inside class. Creating objects, Inheritance, Multiple and Multi Level Inheritance, Function over-riding, the concept of composing objects of a different class in an object, problems on object composition
Unit-4 GUI creation in Python
GUI creation using Python's de-facto GUI package like tkinter or alternative packages like: wxPython, PyQt (PySide), Pygame, Pyglet, and PyGTK. Creating labels, buttons, entry (textbox), combobox, checkbutton, radiobutton, scrolledText (textarea), spinbox, progressbar, menubar, filedialog, tabs etc. Creating GUI simple games like Tic-Tac-Toe

Reference Books:

- Think Python 2nd Edition - How to Think Like a Computer Scientist, Allen B Downey, O'Reilly publication
- Learn Python 3 the Hard Way, Zed A. Shaw, Pearson publication
- Head First Programming: A Learner's Guide to Programming using the Python Language, Paul Barry David Griffiths Barry Griffiths, O'Reilly publication
- Dive into Python 3, Mark Pilgrim, Apress publication

Python Programming Lab

CSP 1028 **0 – 0 – 4 = 2**

List of experiments:

1 Write a program to add two numbers.
2 Write a program to calculate grade of a student.
3 Write a program to print following pattern.

```
*
**
***
****
```

4 Write a program to print table of a number.
5. Write a program to print following pattern:

```
0
01
012
```

6. Write a program to add and multiply numbers using user define functions.
7. Write a program to concatenate strings in Python.
8. Give at least five examples of inbuilt functions of Python.
9. Give at least five examples of inbuilt Math functions of Python.
10. Write a program to calculate factorial of a number using recursion.
11. Write a program to make a List in Python and perform following operations on List:
    a) Length using len() function
    b) Print element at index 0
    c) Adding an element to the list using + operator
    d) Appending an element to the list
    e) Negative indexing in list
    f) Remove the first occurrence of element a from list
    g) Reverse the list
    h) Sort list
12 Write a program to demonstrate use of Dictionary in Python with their inbuilt functions.
13 Write a program to demonstrate use of Set in Python with their inbuilt functions.
14 Write a program to demonstrate use of Tuple in Python with their inbuilt functions.
15 Write a program to calculate Median using List.
16. Write a program to calculate Mode using List.
17 Write a program to calculate Mean using List.
18 Write a program to inherit properties of a person to a student using inheritance in Python.
19 Write a program to calculate Coefficients of given numbers.
20 Write a program to calculate Covariance of given numbers.
21 Write a program to plot a graph using python library.
22 Write a program to make a class Vehicle and their properties.
23 Write a program to make a game Rock-Paper-Scissor.
24 Write a program to make classes for bird and animal with their properties and simulate a zoo like environment.
25 Write a program to make a GUI to take input from user and display.

Digital Electronics

ECL 2070 **3 - 0 - 0 = 3**

Course Outcomes

CO1	To provide the skills to efficiently acquire knowledge on digital electronic circuit analysis and design.
CO2	To acquire Knowledge of various number systems and codes from historic point of view.
CO3	To understand the logic families in digital circuits.
CO4	To obtain the ability to analyze various aspects of sequential circuit design.
CO5	To learn the design procedure for Sequential Circuits and data converters.

Course Contents:

Basic concepts of Boolean Algebra: Review of number systems - Binary, Hexadecimal, conversion from one to another, complement arithmatic, Signed and unsigned numbers and their arithmetic operations. BCD, Excess-3, Gray and Alphanumeric codes. Review of Boolean algebra, De-Morgan's Theorems, Standard Forms of Boolean Expressions, Minimization-Techniques: K-MAPS, VEM Technique, Q-M (Tabulation) method.

Logic Gates & families: Logic Families: TTL, MOS, CMOS, Bi-CMOS; Performance parameters of IC families: input and output loading, fan-in, fan-out, tri-state, current drive, voltage levels, noise margins, power-speed tradeoff; Unused inputs; Interfacing between logic families.

Combinational Logic Circuits: Problem formulation and design of Basic Combinational Logic Circuits, Combinational Logic Using Universal Gates. Basic Adders, ALU, Parity-Checkers and Generators, Comparators, Decoders, Encoders, Code Converters, Multiplexer (Data Selector), De-multiplexers

Sequential Circuits: Latches, Flip-flops (SR, JK, T, D, Master/Slave FF,) Edge-Triggered Flip-Flops, Flip-Flop Operating Characteristics, Basic Flip-Flop Applications, Asynchronous Counter Operation, Synchronous Counter Operation, Up/Down Synchronous Counters.

Shift registers & Memories

Shift Register Functions, Serial In - Serial Out Shift Registers, Serial In - Parallel Out Shift Registers, Parallel In - Serial Out Shift Registers, Parallel In - Parallel Out Shift Registers, Bidirectional Shift Registers,Basics of Semiconductor Memories, Random-Access Memories (ROM), Read Only Memories (ROMs), Programmable ROM's (PROMs and EPROM's), PAL, PLA.

A/D and D/A convertor

Characteristics of ADC, Types of ADC- SAR, Dual Slope, Flash ADC. Characteristics of DAC, R-2R Ladder, Weighted Resistance Type

Circuit and electrical interfacing considerations

Transmission line effect, reflection, crosstalk, Noise sources, shielding and decoupling

Reference Books:

- "Digital Fundamentals" by Thomas L. Floyd, Prentice Hall, Inc
- "Digital Systems - Principles and Applications" by Tocci, R. J. and Widner, Prentice Hall,
- Switching and finite automata theory: Z V Kohavi.–TMH
- Digital Logic Circuit Analysis & Design, by Victor P. Nelson, H. Troy Nagle, Bill D. Carroll and J. David Irwin, Prentice Hall,
- Digital logic and computer design: M Morris Mano –PHI
- Modern digital electronics: R.P. Jain. TMH
- *Digital Design: Principles and Practices, by* Wakerly J F, Prentice-Hall,
- "Digital Experiments Emphasizing Systems and Design," by David Buchla, Prentice Hall, Inc,

Digital Electronics Lab

ECP 2070 **0 - 0 - 2 = 1**

1. Study of PIN diagram of various ICs & to test the logic gates and verify their truth table.
2. Implementation of Half adder, Full adder &Halfsubtracter using NAND gates only.
3. Implementation of Boolean functions of three and four variables using 74153 (4:1) Mux.
4. Implementation of De-multiplexer, decoder and encoder.
5. To add two 4 bit binary numbers using 7483.
6. To compare two 4 bit binary number using 7485 (magnitude comparator).
7. To verify the operation of different modes of shift Register using 7495.
8. To design an asynchronous counter of any modulus using JK FF's (7473).
9. To design a synchronous counter of any arbitrary count using 7473.
10. Design of BCD to seven-segment display using logical gates ICs.
11. To study and verification by truth tables of SR, JK, MSJK, D & T flip flops.
12. To design and test non-sequential counter and study of shift registers.

Engineering Mathematics II

MTL 1026 **3 - 0 - 0 = 3**

Course Outcomes

CO1	Understand the concepts of vector calculus like directional derivative, gradient, divergence and curl, and their applications.
CO2	Learn and apply the concepts of vector integral calculus for the computation of work done,

	circulation, and flux.
CO3	Formulate the differential equations concerning physical phenomena like electric circuits, wave motion, heat equation etc.
CO4	Learn various methods of solution of ordinary and partial differential equations.
CO5	Solve various partial differential equations arising in heat conduction problems and wave propagation problems.

Course Contents:

Unit-I **(18** ContactPeriods)

Vector Calculus:
Beta & Gamma functions. Differentiation of vector functions of scalar variables. Gradient of a scalar field, Divergence & Curl of a vector field and their properties.Line & surface integrals, Greens theorem, Stokes Theorem and Gauss Theorem both in vector & Cartesian forms (statement only) with simple applications.

Unit-II **(15** ContactPeriods)

OrdinaryDifferentialEquation(ODE): Formation of ODE, definition of order and degree of ODE and solution, ODE's of first order, method of separation of variables, homogeneous and non-homogenous differential equations and their solution, exactness and integrating factor, Bernoulli equation, linear ODE's of order, operator method, method of undetermined coefficients, method variation of parameters, solution of simple simultaneous ODE's.

Unit-III **(18** ContactPeriods)

Partial Differential Equation(PDE): Formation of (PDE), Solution of PDE bydirect integration, Lagrange's linear equation, Non-linear PDE of first order, Method ofseparation of variables, Wave & Laplace equations (Two dimensional Polar & Cartesian Co-ordinates).

Reference Books:

- E. Kreysig, Advanced Engineering Mathematics, Wiley 10th edition2011.
- Frank Ayres , Vector Analysis, Mc Graw Hills, 6th edition2011.
- T. Marsden and W.H. Freeman,VectorCalclus, Freeman, 6 edition2011.
- G.Simons,DifferentialEquationswithApplications,TMH**,**McGraw-HillHigher Education; 2 edition1991.
- S.L. Ross, Differential Equations, Wiley 3rd edition1984.
- R. Zalman, A Course in Ordinary and PDEs, Academic Press, 1st edition2014.

Discourse on Human Virtues

PCL 1067 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the relevance of human values and peaceful co-existence
CO2	Widen their perspectives in moral decision making
CO3	Develop right understanding with respect to the basic aspirations of human life
CO4	Gain holistic understanding of the interrelatedness of individual, family, society and nature
CO5	Enhance clarity, assurance & purposefulness of life

Course Contents:

Unit I

What is Value Education?
Knowledge and Skill
Value and Virtue
Moral Agency and the Notion of Dharma
Freedom of Will and Determinism

Unit II

Understanding Human Existence: Human Being and Human Person
The Basic Human Aspirations: Continuous Happiness and Prosperity
Understanding harmony at the level of Individual, Family and Society

Unit III

Understanding harmony at the level of Nature
Cardinal Human Virtues such as Compassion, Wisdom, Justice, Tolerance, Non-violence, Service to Humanity with the help of suitable illustrations

Reference Books:

- Gurucharan Das, *The Difficulty of Being Good*. New Delhi: Penguin Books, 1990 (Chapter 3)
- Herry G. Frankfurt (1971). Freedom of the Will and the Concept of a Person. *The Journal of Philosophy*, 68 (1): 5 – 20.
- R.R. Gaur et al, *A Foundation Course in Human Values and Professional Ethics*. New Delhi: Excel Books, 2006.
- Excerpts from relevant books supplied by the instructor as and when required.

Workshop

MEP 1114 **0 - 0 - 2 = 1**

Course Outcomes

CO1	Study and practice on machine tools and their applications so that students should know and operate the machine tools and perform various processes in welding, sheet metal, smithy and machines shop.
CO2	Students should understand the functioning and applications ofcutting tools, machines, processes ; like fabrication of joints using arc welding, seam joints, forging and taper turning
CO3	Students should document the job performed, safety precautions observed while performing experiment on different machine tools.
CO4	Students should perform the jobs, safety precautions taken while performing the experiments using various tools/ machine tools.

Carpentry shop:Tools and Equipment, Making of Various Joints, Pattern Making.
Foundry Shop: Tools and Equipments, Preparation of Moulds of Simple Objects Using Single Piece, Two Piece and Match Plate Patterns.
Fitting Shop:Tools And Equipments, Practice in Chipping, Filing and Drilling, Making of V, Dovetail and Square Joints of M.S Flat.
Welding Shop:Tools and Equipments, Making of Various Joints Using Gas Welding and Arc Welding (MIG Welding) ,Bead Formation in Horizontal, Vertical and Overhead Positions, Brazing and Soldering Operations.
Sheet Metal Shop:Tools and Equipments, Making Tray, Cone, etc. with GI Sheet Metal
Machine Shop:Introduction to Various Lathe Operations and Practice on Milling, Drilling Machines, etc.

Reference Books:
1. Raghuvanshi, B. S. - Workshop Technology–Vol 1, Dhanpat Rai & Sons, New Delhi.
2. Gupta, R. B. - Production Technology, Satyaprakashan, New Delhi.
3. Swarn Singh - Workshop Practice, Kataria& Sons, New Delhi.
4.Upadhyay, R. – Manufacturing Practice, Kataria& Sons, New Delhi.
5. Narayana, K L Kannaiah P. - Manual on Workshop Practice, Scitech Publishers, Chennai

Discrete Structures

MTL 2024 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the basic principles of sets, functions and relations and their applications.
CO2	Understand the concept of lattice and Boolean algebra with their application in simplification in switching circuits.
CO3	Understand the fundamentals of algebraic structures like group, ring, field and vector spaces.
CO4	Understand the concept of recurrence relations and generating functions and their applications in problems of combinatorics.
CO5	Write an argument using logical notation and determine if the argument is or is not valid.
CO6	Understand the concept of metric space and its application in brief

Course Contents:

Unit-I: (12 Contact Periods)
Sets, Binary relation, equivalence relation.Functions, Injective, Surjective & Bijective mappings.Partial order relations, PO-set, Lattice & Boolean algebra. Algebraic structures, Semi group, Monoid, Group, Cyclic group, Subgroup, Normal subgroup, Quotient group, Homomorphism of groups.
Unit-II: (12 Contact Periods)
Ring, Integral domain, Field.Vector space, Linear dependence & independence.Basis & Dimension.Combinatorics, Recurrence relations & Generating functions.
Unit-III: (12 Contact Periods)
StatementCalculus- sentential connectives, Truth tables, Logical equivalence, Deduction theorem.Predicate Calculus- Symbolizing everyday language, validity and consequence, first order theories.
Definition and examples of Metric space, Open & Closed spheres, Open & Closed sets.
Reference Books:
1. R.R Stoll., Set Theory and Logic, Dover Publications, New ed., 2012.
2. I. N. Herstein, Topics in Algebra, Wiley, new ed., 2004.
3. K. H. Rosen, Discrete Mathematics and Its Applications with Combinatorics and Graph.
Theory (English) Macgraw Hill Education, 7th Edition
4.P.K. Jain and Khalil Ahmad, Metric Spaces, Narosa, 2nd ed., 2004.

Introduction to Logic

PCL 2042 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Identify the nature and structure of reasoning
CO2	Understand the notion of validity, invalidity and soundness of arguments
CO3	Differentiate good arguments from the bad ones with the help of the methods and principles of logic
CO4	See the pitfalls of language in terms of logical fallacies
CO5	Realize the limitations of scientific generalizations

Course Contents:

Unit-I Propositional Logic (14 Contact Hours)

1. Arguments: Inductive and Deductive Arguments, Truth and Validity
2. Simple and Compound Statements, Truth Functionality
3. Decision Procedures, Truth Tables, Inter-definability
4. Proof Construction and Proving Invalidity

Unit-II Syllogistic Logic (12 Contact Hours)

5. Categorical Propositions and Squares of Opposition
6. Categorical Syllogisms: Moods and Figures
7. Examining Syllogisms using formal rules and Venn diagrams
8. Problem of Existential Import

Unit-III Informal Fallacies, Mill's Method and Predicate Logic (14 Contact Hours)

9. Classification of Fallacies: (a) Fallacies of Relevance, (b) Fallacies of Defective Induction, (c) Fallacies of Presumption, and (d) Fallacies of Ambiguity
10. Mills Method
11. Singular Propositions and General Propositions
12. Quantificational Symbolization, Proving Validity and Invalidity

Reference Books:

- Irving M. Copi, Carl Cohen, and Kenneth McMahon, *Introduction to Logic* (14th edition), New Delhi: Pearson Education Inc., 2014.
- Irving M. Copi, *Symbolic Logic* (V edition), New Delhi: Prentice Hall, 2006.
- P. J. Hurley, *A Concise Introduction to Logic* (IX edition), Belmont: Thomson Wadsworth, 2006.

Theory of Computation

CSL 2041 **3 – 1 – 0 = 4**

Course Outcomes

CO1	Design the FSM and its variants for the given problem
CO2	Able to convert RE to FA, differentiate between Regular and Non-regular languages, argue about diff. properties of Regular Languages
CO3	Define and construct CFG along with corresponding machines, classify the languages into different Normal Forms
CO4	Define and construct various type of TM, argue about decidability/undecidability of the problems

Course Contents:

Unit - I : Introduction

Basic Concepts: Symbols, Strings, Language, Formal Language, Natural Language. Basic Machine and Finite State Machine. Finite Automata: Definition and Construction – Deterministic Finite Automata, Non Deterministic Finite Automat, NFA with Epsilon-Moves, Equivalence of NFA and DFA, Minimization of Finite Automata, Concept of Generalized non-deterministic finite automata.

Unit - II : Regular Expressions, Regular Grammar And Languages

Definition and Identities of Regular Expressions, Regular Grammar and Finite Automata: FA to RG and RG to FA, Left Linear and Right Linear Grammar and Inter-conversion between them. Closure Properties of Regular Languages, Non-regular languages and Pumping Lemma.

Unit - III : Context Free Grammar And Languages

Definition and Construction of CFG, Definition, Parse tree, derivation, ambiguity, Ambiguous Grammar and Removal of Ambiguity. Simplification of Grammar. Normal Forms of Grammar: Chomsky normal form and GNF. Non-Context Free Languages, pumping lemma.

Unit - IV : Pushdown Automata

Definition and Construction of Deterministic pushdown automata (DPDA) and Non-Deterministic pushdown automata (NPDA). Pushdown Automata - Examples and Relation with CFGs, Equivalence of PDAs and CFGs, Closure Properties of CFLs.

Unit - V : Turing Machines & Decidability

Definition and Construction of Turing Machines.Languages of TM.Types of TM. Time Complexity of TM, Halting Problem, Decidability/ undecidability

Reference Books:

1. Hopcroft Ulman, "Introduction To Automata Theory, Languages And Computations", Pearson Education Asia, 2nd Edition
2. K.L.P Mishra, N. Chandrasekaran, " Theory Of Computer Science(Automata, Languages and Computation)", Prentice Hall India, 2nd Edition
3. John C. martin, "Introduction to Language and Theory of Computation", TMH, Third Edition. 978-0-07-066048-9.
4. Michel Sipser "Introduction to Theory of Computation" Thomson Course Technology, Second Edition 0-534-95097-3.
5. Peter Linz, "An introduction to formal languages and Automata", Narosa Publication.

Computer Organization & Architecture

CSL 2061 **3 – 1 – 0 = 4**

Course Outcomes

CO1	To Learn basic micro operations and organization of a basic digital computer
CO2	To Learn Overall organization of CPU, pipelining and vector processing
CO3	To understand various various arithmetic algorithms and communication techniques with Input/output devices.
CO4	To understand the organization and operation of various memory

Course Contents:

Unit-I: Introduction
Overview of Digital Fundamentals

Unit-II:
Register Transfer and Micro operation
Register Transfer Language, Register Transfer, Bus and Memory Transfer, Arithmetic Micro operations, Logic Micro operations and Shift, Micro operations.

Unit-III:
Basic Computer Organization and Design
Instruction Codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycle, Memory Reference Instructions, Input-Output and Interrupts, Design of Basic Computer, Design of Accumulator Logic.

Unit-IV
Micro-programmed Control Unit
Control Memory, Address Sequencing.
Central Processing Unit:Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.

Unit-V
Computer Arithmetic
Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operation, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

Unit-VI
Input–Output Organization
Peripheral devices, Input – Output interface, Asynchronous Data Transfer, Modes of Data Transfer, Priority Interrupt, Direct Memory Access, Input – Output Processor.

Unit-VII
Memory Organization
Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Unit-VIII
Multiple ProcessOrganization
Flynn's classification of parallel processing systems, pipelining concepts.

Reference Books:

1. Computer System and Architecture, Mano, M , PHI
2. Computer Organization & Design, Pal Chaudhuri, P., PHI
3. Digital Computer Electronics: An Introduction to Microcomputers, Malvino
4. Digital Principles and Applications, 4/e ,Malvino , M G Hill
5. Computer Architecture and Organization, Hayes. J.P , M G Hill
6. Computer Organization & Architecture, Stallings, W , PHI

Object Oriented Programming

CSL 2022 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Knowledge and understanding of OOP using C++ that are new to programmers of traditional structured language like C .
CO2	Ability to write simple programs in C++ language by using basic control structures in addition to C, function overloading, constructor and destructor, run time memory allocation using new and delete etc.
CO3	Implementing the concept of OOP with C++ using classes and objects, operator overloading , Inheritance, polymorphism, template generic programming,exception handling , writing of large programs code with files and implement the various operations on them.

CO4	Ability to design and develop application model for on various software requirement of large databases.

Course Contents:

- Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming.
- concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.
- Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists. Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.
- Inheritance: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors. Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors
- Standard Input/output: Concept of streams, hierarchy of console stream classes, input/output using overloaded operators >> and << and member functions of i/o stream classes, formatting output, formatting using ios class functions and flags, formatting using manipulators.
- Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures. Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.
- Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.
- Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples.
- Files: File streams, hierarchy of file stream classes, error handling during file operations, reading/writing of files, accessing records randomly, updating files.
- Introduction to STL: Different types of Containers, Algorithms, Iterators and their implementations .

Reference Books:

1. Lafore R., Object Oriented Programming in C++, Waite Group.
2. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill.
3. R. S. Salaria, Mastering Object-Oriented Programming with C++, Salaria Publishing House.
4. Bjarne Stroustrup, The C++ Programming Language, Addison Wesley.
5. Herbert Schildt, The Complete Reference to C++ Language, McGraw Hill-Osborne

Object Oriented Programming Lab

CSP 2022 **0 – 0 – 2 = 1**

List of experiments:

1. [Classes and Objects] Write a program that uses a class where the member functions are defined inside a class.
2. [Classes and Objects] Write a program that uses a class where the member functions are defined outside a class.
3. [Classes and Objects] Write a program to demonstrate the use of static data members.
4. [Classes and Objects] Write a program to demonstrate the use of const data members.
5. [Constructors and Destructors] Write a program to demonstrate the use of zero argument and parameterized constructors.
6. [Constructors and Destructors] Write a program to demonstrate the use of dynamic constructor.
7. [Constructors and Destructors] Write a program to demonstrate the use of explicit constructor.
8. [Initializer Lists] Write a program to demonstrate the use of initializer list.
9. [Operator Overloading] Write a program to demonstrate the overloading of increment and decrement operators.
10. [Operator Overloading] Write a program to demonstrate the overloading of binary arithmetic operators.

11. [Operator Overloading] Write a program to demonstrate the overloading of memory management operators.
12. [Typecasting] Write a program to demonstrate the typecasting of basic type to class type.
13. [Typecasting] Write a program to demonstrate the typecasting of class type to basic type.
14. [Typecasting] Write a program to demonstrate the typecasting of class type to class type.
15. [Inheritance] Write a program to demonstrate the multilevel inheritance.
16. [Inheritance] Write a program to demonstrate the multiple inheritance.
17. [Inheritance] Write a program to demonstrate the virtual derivation of a class.
18. [Polymorphism] Write a program to demonstrate the runtime polymorphism.
19. [Exception Handling] Write a program to demonstrate the exception handling.
20. [Templates and Generic Programming] Write a program to demonstrate the use of function template.
21. [Templates and Generic Programming] Write a program to demonstrate the use of class template.
22. [File Handling] Write a program to copy the contents of a file to another file byte by byte. The name of the source file and destination file should be taken as command-line arguments,
23. [File Handling] Write a program to demonstrate the reading and writing of mixed type of data.
24. [File Handling] Write a program to demonstrate the reading and writing of objects.

Operating Systems

CSL 2051 **3 – 0 – 0 = 3**

Course Outcomes

CO1	To learn different types of operating systems along with of history of operating systems and basic functions of operating systems
CO2	Students will have knowledge of Process management, process synchronization and deadlock handling algorithms, inter-process communication and CPU scheduling algorithms used in operating system. Memory management and virtual memory concepts, I/o Devices management, file management
CO3	Students will be able to analyze and implement various algorithms used for management, process scheduling, memory allocation and process communication in operating system.
CO4	Analyse the structure of OS and basic architectural components involved in OS design.

Course Contents:
Introduction to OS: Processor management, memory management, file system management, system calls.
Process management: Scheduling levels, quantities to be optimized , preemptive/non preemptive, interrupting clock, FIFO , shortest job first, shortest remaining job first, round robin, priority, multilevel queues, multilevel feedback queues.
Concurrent processes: Mutual exclusion and Bernstein's conditions, Fork/Join construct, PARBEGIN/PAREND construct; semaphores: use of semaphores to complement PARBEGIN/PAREND; critical section problem ; 2 process critical section problem and solution, both H/W and S/W; monitors; message passing ; case studies: dining philosophers problem, reader writer problem and disk head scheduler problem.
Memory management: Single user contiguous: protection; fixed partition multiprogramming; protection, fragmentation, relocation; variable partition multiprogramming: compaction, storage placement strategies; multiprogramming with storage swapping; paging: segmentation; paging and segmentation together; virtual memory: page replacement and strategies, locality, working sets, page fault frequency, demand paging, optimization technique.
Dead locks: Resource concepts, necessary conditions, resource allocation graph, deadlock prevention: three strategies of Havender, deadlock avoidance: Bankers algorithm, deadlock detection: reduction of resource allocation graph, deadlock recovery.
File systems: directory organization, functions, data hierarchy, blocking and buffering, file organization, free space management, allocation techniques: contiguous, non contiguous; sector oriented linked; block: block chaining , index block chaining, block oriented file mapping;
Device management: types: block, character; PIO, DMA, I/O channels, virtual devices.
Disk scheduling: operations of disks, quantities to be optimized, seek optimization : FCFS, SSTF, SCAN, C-SCAN, M-STEP SCAN, Eschenbach; rotation optimization, system consideration, disk caching and other optimizations.
Reference Books:

1. Operating system concepts : Silberschatz, Addison Wesley Longman
2. Modern Operating Systems : Tanenbaum, PH(I)
3. Operating systems : H.M.Deitel, Addison Wesley Longman
4. Operating systems :Madnick and Donovan, McGraw-Hill I.E.

Operating Systems Lab

CSP 2051 **0 – 0 – 2 = 1**

List of Experiments :

1) Write a shell script to ask your name, program name and enrolment number and print it on the screen.
2) Write a shell script to find the sum, the average and the product of the four integers entered
3) Write a shell program to exchange the values of two variables
4) Find the lines containing a number in a file
5) Write a shell script to display the digits which are in odd position in a given 5-digit number
6) Write a shell program to reverse the digits of five-digit integer
7) Write a shell script to find the largest among the 3 given numbers
8) Write a shell program to search for a given number from the list of numbers provided using binary search method
9) Write a shell program to concatenate two strings and find the length of the resultant string
10) Write a shell program to find the position of substring in a given string
11) Write a shell program to display the alternate digits in a given 7-digit number starting from the first digit
12) Write a shell program to find the gcd for the 2 given numbers
13) Write a shell program to check whether a given string is palindrome or not.
14) Write a shell program to find the sum of the series sum=1+1/2+…+1/n
15) Write a shell script to find the smallest of four numbers
16) Write a shell program to add, subtract and multiply the 2 given numbers passed as command line arguments
17) Write a shell program to convert all the contents into the uppercase in a particular file
18) Write a shell program to count the characters, count the lines and the words in a particular file
19) Write a shell program to concatenate the contents of 2 files
20) Write a shell program to find factorial of given number
21) WAP that accepts user name and reports if user logged in.
22. WAP that takes a filename as input and checks if it is executable, if not make it executable.
23. WAP which displays the following menu and executes the option selected by user:
1. ls
2. pwd
3. ls –l
4. ps -fe
24) Write a shell script to find the average of the numbers entered in command line
25) Write a shell script to sort the given numbers in descending order using Bubble sort
26) Write a shell program to find the sum of all the digits in a given 5-digit number
27) Shell script to find occurrence of particular digit in inputted number
28) Write a shell script to print following pattern.

```
*
* *
* * *
* * * *
```

29)Write a shell script to print following pattern.

```
1
2 3
4 5 6
```

30) Create a data file called employee in the format given below:

a. EmpCode Character
b. EmpName Character
c. Grade Character
d. Years of experience Numeric
e. Basic Pay Numeric
Sort the file on EmpCode.
Sort the file on EmpName.
Sort the file on
(i) Decreasing order of basic pay
(ii) Increasing order of years of experience.
(iii) Display all records with 'smith' as a part of employee name.

Environmental Studies

BTL 2034 **3 – 0 – 0 = NC**

Course Outcomes

CO1	Give a brief account on interactions within the living and non living entities
CO2	Explain role of human activities in destroying a balance in an ecosystem
CO3	Define the conservation strategies adopted for protecting flora and fauna in terrestrial and aquatic ecosystem
CO4	Define lithosphere, biosphere and atmosphere and role of dwindling resources in degradation of environment.

CO5	Causes of pollution and remedies
CO6	Sustainable development using renewable energy resources.

Course Contents:

Unit-I **Introduction of Environmental Studies CO1 & 2** (12 Contact Periods)
Definition of Environmental studies and its importance.Natural resources and their conservation. Forest resources, water resources and land resources.Environmental Pollution:Definition, Causes, effects and control measures of Air pollution, Water pollution.

Unit-II **Types of ecosystem CO 1,2 & 4** (12 Contact Periods)
Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem, Ecological succession Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem.

Unit-II **Energy sources and sustainable development CO 6, 5 &3** (12 Contact Periods)

Energy resources: conventional and nonconventional sources of energy .Renewable and non-renewable resources Social Issues and the Environment: From Unsustainable to Sustainable development, Water conservation.

Unit-IV **Impact of population growth on environment CO 1,2 & 5** (12 Contact Periods)
Human Population and the Environment: Population growth, Environment and human health, Human Rights, Value Education, Women and Child Welfare. Role of information Technology in Environment and human health.

Unit-V **Visit to sites to assess the impact of human activities CO 1to6** (12 Contact Periods)

1. Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.
2. Field visit for study of simple ecosystems-pond, river, hill slopes, etc., Study of common plants, insects, birds.
3. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

Reference Books:

- Principles of Environmental Science 8th Edition by William Cunningham (Author), Mary Cunningham (Author) ISBN-13: 978-0078036071, ISBN-10: 0078036070
- Ecology and Environment by PD Sharma
- 3.Barron's AP Environmental Science, 6th Edition 6th Edition Gary S. Thorpe MS ISBN-13: 978-1438005522 , ISBN-10: 1438005520
- Climate Change: What Everyone Needs to Know® 1st Edition by Joseph Romm, ISBN-13: 978-0190250171, ISBN-10: 0190250178
- The Wood for the Trees: One Man's Long View of Nature by Richard Fortey, ISBN-13: 978-1101875759, ISBN-10: 1101875755

Computer Network & Communications

CSL 3071 **3– 0 – 0 = 3**

Course Outcomes

CO1	Understand computer networking and data communications
CO2	Understand the standard networking models along with their layers and associated applications
CO3	Be familiar with the different concepts of network protocols
CO4	Analyse the features and operations of various protocols

Course Contents:

Introduction: Uses of Computer Networks, Network Architecture, Reference Model (ISO-OSI, TCP/IP-Overview, IP Address Classes, Subneting), Domain Name Registration & Registrars

The Physical Layer: Theoretical basis for data communication, transmission media-Magnetic Media, Twisted Pair, Baseband Coaxial Cable, Broadband Coaxial Cable, Fibre Cable, Structured Cabling, Cable Mounting, Cable Testing, Wireless transmission, the telephone system, narrowband ISDN, broadband ISDN and ATM.

The Data Link Layer: Data link layer design issues, error detection and correction, data link protocols, sliding window protocols, Examples of Data Link Protocols.

The Medium Access Sublayer: The channel allocation problem, multiple access protocols, IEEE standard 802 for LANS and MANS, high-speed LANs, satellite networks, Network devices-repeaters, hubs, switches and bridges.

The Network Layer: Network layer design issues, routing algorithms, congestion control algorithm, internetworking, the network layer in the internet, the network layer in ATM networks.

The Transport Layer: A simple transport protocol, internet transport protocols, UDP, introduction to TCP, service model, TCP connection establishment, transmission policy, congestion control, timer management, wireless TCP and UDP, transactional TCP.

The Application Layer: HTTP, electronic mail, SNMP, SMTP, DNS.

Reference Books:

1. Computer Networks, 3rd Ed, Tananbaum A.S, PHI
2. Computer Networks-Protocols, Standards and Interfaces, Black U. PHI

3. Computer Communication Networks, Stallings W. , PHI
4. Data communication and networking, B. F. Ferouzan, TMH

Computer Network & Communications Lab

CSP 3071 **0– 0 – 2 = 1**

List of Experiments:

1. Introduction to NetSim, development of a layout and analyse performance factors generated based on the constructed network layout.
2. Understand IP forwarding within a LAN and across a router using NetSim.

(a) Disable static ARP
(b) Enable static ARP

3. Understand the working of "Connection Establishment" in TCP using NetSim.

(a) Disable static ARP
(b) Enable static ARP

4. Study the working of spanning tree algorithm by varying the priority among the switches
5. Study the throughput of the communication link while using different congestion control algorithms i.e. Congestion avoidance (Old Tahoe) and Fast Retransmit (Tahoe), Reno
6. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied
7. Plot the characteristic curve throughput versus offered traffic for a Slotted ALOHA system
8. Plot the characteristic curve throughput versus offered traffic for a Pure ALOHA system
9. To determine the optimum persistence of a p-persistent CSMA / CD network for a heavily loaded bus capacity
10. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)
11. Understand the impact of bit error rate on packet error and investigate the impact of error of a simple hub based CSMA / CD network
12. Analyze the performance of a MANET, (running CSMA/CA (802.11b) in MAC) with increasing node density
13. Analyze the performance of a MANET, (running CSMA/CA (802.11b) in MAC) with increasing node mobility
14. Study the working of BGP and formation of BGP Routing table

Design & Algorithm Analysis

CSL 3032 **3– 0 – 0 = 3**

Course Outcomes

CO1	Analyze the run time complexity of algorithms when developed using different approaches like Greedy, Dynamic Programming, Divide and Conquer etc.
CO2	Identify an appropriate data structure and approach while designing an algorithm for a specific problem.
CO3	Analytically examine the correctness of algorithms on the basis of recurrence relations, inductive proofs etc.
CO4	Analyze the Best, Worst and Average Case running time of algorithms and how it is affected by the nature of input variables.
CO5	Analyze various graph algorithms and deploy these algorithms to model engineering problems.

Course Contents:

Introduction: Definition of algorithm, algorithm specification, performance analysis: Time and space analysis, Asymptotic, recurrence relations.

Design of Efficient algorithms: Graphs, trees, recursion, divide and conquer, balancing, dynamic programming.

Sorting: Merge sort, Heaps and maintaining the heap properties, building a heap, Heap sort, Quicksort: algorithm, performance and anlaysis, Sorting without comparison: Radix sort, counting sort, bucket sort.

Some data structures: Hash tables, hash functions, Open addressing, Binary search trees-insertion and deletion, Balanced trees: AVL trees, m-way trees, B Trees, 2-3 Trees, Binomial heaps: Binomial trees and operations on binomial heaps.

Advanced design and analysis Techniques: Dynamic programming: Definition, Matrix-chain multiplication, Optimal binary search trees, Longest common subsequence, 0-1 knapsack problem.

Greedy algorithms: Definition, Fractional knapsack problem, Huffman coding, Task-scheduling problem.

Divide and conquer algorithm: Definition, Strassen's matrix multiplication, finding minimum and maximum from an array.

Backtracking: Definition, n-queens problem, sum of subset problem.

Graph algorithm: Elementary graph algorithms, Breadth-first and Depth-first search, Minimum spanning trees: Prim's and Krushkal's algorithm, Single source shortest path problem, Bellman-Ford algorithm, Floyd-Warshall algorithm, Johnson's algorithm.Integer and Polynomial arithmetic:Polynomial addition and multiplication.

Reference Books:

- Introduction to Algorithm, TH Corman, Charles E, PHI
- The design and anal. Of Comp. Algorithms Aho, Hopcroft, Ullman Addition Wesley
- Computer Algorithms, Galgotia., Horowitz, Sahni and Rajsekaran

Design & Algorithm Analysis Lab

CSP 3032 **0– 0 – 2 = 1**

List of experiments

1. Write a program for Binary Search using divide and conquer strategy.
2. Write a program for Max-Min using divide and conquer strategy.
3. Write a program for Merge Sort using divide and conquer strategy.
4. Write a program for Quick Sort using divide and conquer strategy.
5. Write a program to select the kth element using divide and conquer strategy.
6. Write a program to implement Knapsack problem using greedy approach.
7. Write a program to implement Dijkstras Algorithm using greedy approval.
8. Write a program to generate Optimal Matrix Chain multiplication series using dynamic programming approach.
9. Write a program to generate Longest Common Subsequence using dynamic programming approach.
10. Write a program to generate single source shortest path using Bellman Ford algorithm.
11. Write a program to find and generate all pairs shortest path using Floyd Warshall algorithm.
12. Write a program to implement Jonson's Algorithm.
13. Write a program to Sort the elements using Counting sort.
14. Write a program to Sort the elements using Bucket Sort .
15. Write a program to sort the element using Radix sort .
16. Write a program to implement Kruskal's Algorithm for finding Minimum Spanning Tree.
17. Write a program to implement Prim's Algorithm for finding Minimum Spanning Tree.
18. Write a program to implement Breadth First search Algorithm.
19. Write a program to implement Depth First search Algorithm.

Database Management Systems

CSL 3081 **3– 0 – 0 = 3**

Course Outcomes

CO1	Define the terminology, features, classifications, and characteristics embodied in database systems.
CO2	Convert any information model into a relational database schema and implement the same using SQL
CO3	Formulate the data requirement in terms of Relational algebra operation and query languages operations
CO4	Apply the normalization theory to normalize the given Database schema
CO5	Understand the requirement of ACID properties & their implementation

Course Contents:

Introductory Database Concepts: Introduction to data processing, overview of files and file systems, drawbacks of files systems, concept of a database, data abstraction and data independence, data models, database language, database users and administrators, transaction management, database system structure.

Entity Relationship Model: Basic concepts, constraints, design issues, entity relationship diagram, week entity sets, extended ER features, design of ER database schema, reduction of ER schema to tables.

Relational Model: Concept of a relation, primary and secondary keys, foreign keys, structure of relational databases, the relational algebra and extended relational algebra operations, formulation of queries, modification of the database, views.

SQL: Background, basic structure, set operations, aggregate functions, null values, nested queries, views, complex queries, database modification, DDL, embedded SQL, stored procedures and functions, dynamic SQL, other SQL features.

Integrity & Security: Domain constraints, referential integrity, assertions, triggers, triggers and assertions in SQL, security in authorization in SQL.

Relational Database Design: First normal form, pitfalls in relational database design, functional dependencies, decomposition, desirable properties of decomposition, boycecodd normal form, third and fourth normal forms, other normal forms.

Transactions: Transaction concept, transaction state, implementation of atomicity and durability, concurrent executions, serializability, recoverability, implementation of isolation, transaction definition in SQL.
Concurrency Control: Lock based protocols, timestamp based protocols, validation based protocols, multiple granularity, multiversion schemes, deadlock handling, inset and delete operations.
Recovery Systems: Failure classification, storage structure, recovery and atomicity, log based recovery, shadow paging, recovery with concurrent transitions, buffer management.

Reference Books:
- Principles of Database System, Ullman ,Galgotia.
- Database System Concepts,Silberschatz, Korth&Sudarshan, McGraw Hill.
- Database Management Systems , Raghu Ramakrishnan, McGraw Hill.
- Fundamentals of Database Systems , Elmasri&Navathe Addison Wesley

Database Management Systems Lab

CSP 3081 **0– 0 – 2 = 1**

List of experiments

1. Creation of a database and writing SQL queries to retrieve information from the database.

1.1 Data Definition Language (DDL).
   a. CREATE
   b. ALTER
   c. DROP
   d. TRUNCATE
   e. RENAME
   f. COMMENT

1.2 Data Manipulation Language (DML)
   a. INSERT
   b. UPDATE
   c. DELETE
   d. SELECT

2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, Synonyms, Sequence, Indexes,

   Save 3.1. Implementation of Views.

   3.2. Implementation of Synonyms
   3.3. Implementation of Sequence
   3.4. Implementation of Indexes
   3.5. Implementation of Save point.
4. Creating an Employee database to set various constraints.

   (a). Primary key, (e).Null, (i). Disable Constraints

   (b).Foreign Key,` (f). Not null, (j). Drop Constraints

   (c). Check, (g) . Default,

   (d). Unique, (h). Enable Constraints,

5. Creating relationship between the databases.
   5.1 Implementation of set operations
   5.2. Implementation of Nested Queries / Sub queries
   5.2. Implementation the Join Operations
6. Creation and use of Triggers
7. Creation of functions using PL/SQL.

Microprocessors & Interfacing

ECL 2060 **3 – 0 – 0 = 3**

Course Outcomes

CO1	List and specify the various features of microprocessor, memory and I/O devices including concepts of system bus.
CO2	Identify the various elements of 8085 microprocessor architecture, its bus organization including control signals.
CO3	List the pin functions of the 8085 microprocessor.
CO4	Describe the 8085 processor addressing modes, instruction classification and function of each instruction and write the assembly language programs using 8085 instructions.
CO5	Explain the concepts of memory and I/O interfacing with 8085 processor with Programmable devices.

CO6	List and describe the features of advance microprocessors.

Course Contents:

Unit-I

8085 Architecture: Introduction to microprocessors and microcontrollers, 8085 Processor Architecture, Internal operations, Instructions and timings, Programming the 8085 – Introduction to 8085 instructions, addressing modes and Programming techniques with Additional instruction.

Unit-II

Stacks and subroutines, interfacing peripherals - Basic interfacing concepts, interfacing output displays, interfacing input keyboards. Interrupts - 8085 Interrupts, Programmable Interrupt Controller (8259A). Direct Memory Access (DMA) – DMA Controller (Intel 8257), Interfacing 8085 with Digital to Analog and Analog to Digital converters.

Unit-III

Programmable peripheral interface (Intel 8255A), Programmable communication interface (Intel 8251), Programmable. Interval timer (Intel 8253 and 8254), Programmable Keyboard / Display controller (Intel 8279).Serial and parallel bus standards RS 232 C, IEEE 488.

Unit-IV

Introduction to Microcontrollers, 8051 – Architecture – Instruction set, Addressing modes and Programming Techniques. Comparison of various families of 8-bit micro controllers. System Design Techniques Interfacing of LCD, ADC, Sensors, Stepper motor, keyboard and DAC using microcontrollers Communication standards – serial RS232 and USB

Unit-V

Microprocessor Applications and trends in microprocessor Technology – 8-bit, 16-bit and 32-bit microprocessors. Advanced Processor Architecture – Register structure, Instruction set, Addressing modes of 8086.Features of advanced microprocessors.80386, 80486, Pentium and Multi-Core Processors.

Reference Books:

1. "Microprocessor Architecture, Programming, and Applications with the 8085" by R Gaonkar
2. "The 8051 Microcontroller and Embedded Systems : Using Assembly and C" by Muhammad Ali Mazidi
3. "Introduction to Microprocessors and Microcontrollers" by Crisp John Crisp
4. "Microprocessors And Microcontrollers" by A NagoorKani
   Barry B. Brey, The Intel Microprocessor, 8086/8088,8018/80188, 80286, 80386, 80486, Pentium and Pentium pro-processors – architecture, Programming and interfacing, 4 Edition, Prentice Hall 1993.

Microprocessors & Interfacing Lab

ECP 2060 **0 – 0 – 2 = 1**

List of Experiments

1. Write a program to add two 8-bit numbers stored in the memory location 2300H & 2301H and store the result in memory location 2302H and the carry in location 2303H.
2. Write a program to transfer 16 bytes of data stored at memory location 2300H to 2400H.
3. Write a program to add two twodigit BCD numbers stored in memory location 2100H & 2101H, the 3 digit BCD result should be stored from memory location 2102H onwards.
4. Write a program to add two 16 bit numbers stored in memory location 2100H & 2102H and store the sum at memory location 2104H onwards.
5. Write a program to subtract two 8-bit numbers.
6. Write a program to subtract two 16-bit numbers
7. Write a program to subtract two digit BCD numbers stored at memory location 2100H & 2101H and store the result in memory location 2102H.
8. Write a program to unpack two digit BCD number stored at memory location 2100H and store the unpacked BCD numbers at memory locations 2101H & 2102H.
9. Write a program to read a two digit BCD number stored at memory location 2100H and switch the digits of the BCD number and store the result at memory location 2101H.
10. Write a program to sort 16 numbers stored at memory location 2100H to 210FH in ascending order.
11. Write a program to convert an 8-bit binary number to ASCII Hex Code.
12. Write a program to convert a two digit BCD number, stored at location 2100H, into its binary equivalent number and store the result in memory location 2200H.
13. Write a program to convert a Binary number to its equivalent BCD number.
14. Write a Program to generate a ramp waveform.
15. Write a Program to generate staircase waveform
16. Write a Program to display the character "V" in 8x8 LED Matrix.
17. Write a Program to rotate a Stepper Motor in Anticlockwise Direction
18. Write a Program to Control Traffic.
19. Write a program to interface ADC 0808 with the 8085 microprocessor and store the A/D result in memory location 3200H.
20. Write a program to convert an 8-bit binary number to ASCII.

21. Write a program to blink Port C bit 0 of the 8255. Assume address of control word register of 8255 as 0BH. Use Bit Set/Reset mode.
22. Calculate the sum of series of even numbers from the list of numbers. The length of the list is in memory location 2200H and the series itself begins from memory location 2201H. Assume the sum to be 8 bit number so you can ignore carries and store the sum at memory location 2210H.
23. Design a system (both Software and Hardware) that will cause 4 LEDs to flash 10 times when a push button switch is pressed. Use 8255.

Compiler Design

CSL 4053 **3 – 1 – 0 = 4**

Course Outcomes

CO1	Understand the different phases of compiler in detail.
CO2	Analyze the requirement of NFA and DFA in compiler design.
CO3	Case studies of tools available for lexical analysis, parsing like LEX, YACC.
CO4	Understanding and develop code optimization techniques.
CO5	Analyzing and Designing time and space efficient compiler

Course Contents:

Unit I: Introduction

Issues related to programming Language Design, Issues related to Finite-State Machines, Phases of Compiler Design, Lexical Analysis, Error Detection and Recovery.

Unit II: Basic Parsing Techniques

Parsers, Shift-Reduced Parsers, Operator-Precedence Parsing, Predictive Parsers.

Unit III: Top-Down Parsing, Bottom-up Parsing

LL(1) Grammars, Recursive Descent Parsers, LR Grammars – Concepts and Terminology, LR(O) Parsers, SLR(1) Parsers, Canonical LR(1) Parsers, LALR(1) Parsers, using ambiguous grammar. Attributed Translation Grammar, L-Attributed Translation Grammar.

Unit IV: Syntax-Directed Translation (SDT)

SDT Schemes, Implementation of SDTs, Intermediate Code, Parse Trees and Syntax Trees.Three Address Code, Quadruples and Triples. Translation schemes for Declarations, Assignment statements, Boolean Expressions, Flow of control statements, Array references in Arithmetic Expressions, Procedure Calls, Case Statements, and |Structures.

Unit V: Semantic Analysis & Type Checking

Introduction, Implicit-Stacking in Recursive Descent Compilation, Semantic Stacks in Bottom-up Compilation, Action-Symbols in Top-Down Compilation, Type Expressions, Overloaded Functions, Polymorphic Functions.

Unit VI: Symbol Table Handling Techniques

When to construct and Interact with the symbol Table, Symbol-Table Contents, Operations on symbol Table. Symbol Table organizations for Block – Structured Languages.

Unit VII: Run-Time Storage Organization and Management

Static Storage Allocation, Dynamic Storage Allocation, Heap Storage Allocation, Garbage Collection and Compaction.

Unit VIII: Code Optimization

Principal sources of Optimization, Loop Optimization, Loop-Invariant Computation, Induction variable elimination, Other Loop Optimizations, The DAG representation of Basic Blocks. Global Data – Flow Analysis.

Unit IX: Code Generation

Object programs, Problems Code Generation, A simple Code Generator. Register Allocation and Optimization, Code Generation from DAG, PEECPhole optimization.

Reference Books:

1. Principles of Compiler Design; A. V. Aho& J. D. Ullman Narosa
2. The Theory and Practice of Compiler Writing, J Tremblay and Paul G. S.

Java Programming

CSL 3023 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the syntax, control structures, data structures of java programming language. Ability to demonstrate simple Java programmes
CO2	Ability to code any given algorithm, or provide a solution to real-life-problem using JAVA language
CO3	Ability to build Desktop Applications with GUI(Graphical User Interface) and Database connectivity to create real-life/business solutions
CO4	Inculcating the ability to enjoy coding and build simple games like Tic-Tac-Toe etc.
CO5	Ability to use Industry standard IDEs (Integrated Development Environments) like NetBeans/Eclipse for coding, debugging etc.
CO6	Ability to code and manage at least a few thousand lines of code which enforces the use of Industry best practices like documentation etc.

Course Contents:

Unit I: Principles of Object Oriented Programming with Introduction to JAVA

The Traditional approach, drawback of procedure oriented languages, the three basic constructs of OOPS including abstraction and encapsulation, inheritance and polymorphism, comparison of various object oriented languages, Need of java, The creation of java, Basic differences of java and c++, byte code, difference between JDK, JRE, JVM, java applets and applications, java buzzword, three basic constructs of oops applicable to java.

Unit II: Data types, variables, and Arrays

Classification of various data types used in java(including Integer, float, characters, Boolean), closer look at the literals used in java, defining and initialization of variables, type conversion and casting, automatic type promotions in expressions, arrays(one dimensional and multidimensional).

Unit III: Operators and control statement

Arithmetic operators, bitwise operators, relational operators, Boolean logical operators, assignment operator, ? Operator, operator precedence, java's selection statement (if, switch statement), iteration statement(while, do-while, for, nested loops) Jump statement (break, continue).

Unit IV: Classes and Methods

Class fundamentals, declaring objects, assigning object to reference variables, constructors (default and parameterized), this keyword, garbage collection, finalize keyword, method introduction and returning a value from a method, overloading method, overloading constructor, object as parameter, returning objects, recursion, understanding static keyword, final keyword, introduction to inner and nested classes, exploring String class, using command line argument.

Unit V: Inheritance and package introduction and Exception Handling

Inheritance basic, use of super, method overriding, abstract class, Object class, defining a package, access protection, importing a package, introduction to interface, defining a interface, applying a interface, variables in interface, extension of interface, fundamentals of Exception handling, types of exception, use of try and catch, nested try block, throw, throws, finally keywords, java's built in exception, creating your own exception.

Unit VI: Multithreaded Programming and I/O

The java thread model, thread priorities, synchronization, crating a thread, creating multiple thread, using is Alive() and join(),Synchronization in multiple thread, I/O basics, streams(byte and character), reading and writing console input and output, Reading and writing files.

Unit VII: Applet, Event Handling, and AWT

Applet fundamentals, applet architecture, Applet skeleton, passing parameter to applet, Delegation event model, Exploring all Event Classes, Event Listener interface, Adapter class, Anonymous inner class, Window fundamentals, working with frame window, working with graphics, working with color, fonts, layout managers, using of buttons, checkbox, choice lists, lists, scroll bar, text fields, text area, menu bars and menus, and handling the corresponding events generated by above components.

Reference Books:

- Core Java-Volume I & II by Cay S.Horstmann, Gary Cornell, Pearson Education
- Java-How to Program, Deitel and Deitel: PHI Publication
- Thinking in JAVA, Bruce Eckel, Pearson
- Head First Java, Bert Bates & Kathy Sierra, O'Reilly publications
- The Complete Reference Java , Herbert Schildt: TMH

Java Programming Lab

CSP 3023 **0 – 0 – 2 = 1**

List of Experiments:

1. Program to display Hello world
2. Program to understand command line arguments
3. Program to Input values using Scanner/BufferedReader class, do simple calculations and print values
4. Program to learn about data types & various arithmetic/bitwise/logical/unary operators
5. Program to understand loops and conditions
6. Program to generate patterns and series like Fibonacci/Prime/Even/Odd etc.
7. Program to understand Classes & Objects
8. Program to understand Inheritance and its concepts
9. Program to understand Constructor overloading & calling super class constructor
10. Program to understand method overloading and overriding
11. Program to understand the importance of Getters and Setters
12. Program to understand various access modifiers
13. Program to understand various types of comments in Java
14. Program to understand Interfaces, Abstract class, Inner Class
15. Program to understand Final Classes and Methods
16. Program to learn String, StringBuffer, StringBuilder classes
17. Program to BigInteger and BigDecimal classes
18. Program to understand Arrays & do matrix problems
19. Program to understand raw and generic ArrayList, Auto boxing and Unboxing
20. Program to understand concepts like Array of Objects &ArrayList of Objects
21. Program to sort/sorting algorithms
22. Program to understand methods available in Math class

23. Program to understand the Cosmic superclass "Object"
24. Program to understand the concept of Object Cloning
25. Program to compare objects using Comparable
26. Program to understand Collections(HashMap, HashTable, Set, TreeSet etc.) & Iterators
27. Program to understand try-catch-finally block in Exception Handling
28. Program to understand throw and throws keywords, checked and unchecked Exceptions
29. Program to create user defined exceptions
30. Program to understand Multithreading using Thread class and Runnable Interface
31. Program to understand Thread Synchronization
32. Program the classical Problems of Thread Synchronization like Dining Philosophers, Producer-Consumer
33. Program to learn about various (byte/character etc.) streams in Java
34. Program to learn about File I/O
35. Program to Create GUI frames using Swing/AWT and Event Handling
36. Program to understand various layout managers,
37. Program to understand the Adapter classes,
38. Program to connect to database and perform operations like Create Table, Update Table, Select query, Insert query
39. Program to learn about basic Applet concepts
40. Program to strengthen logic building in students using simple/medium level problems from CodeChef etc.

Artificial Intelligence

CSL 3101 **3 – 1 – 0 = 4**

Course Outcomes

CO1	To understand the basics of Artificial Intelligence , Intelligent Agents and its structure
CO2	To understand the basics of Artificial Intelligence , Intelligent Agents and its structure
CO3	To understand the problem solving by various searching techniques
CO4	To understand the concept of informed search and Exploration
CO5	To understand the concept of constraint satisfaction Problems and Adversarial Search
CO6	To Understand what is Reasoning and Knowledge Representation
CO7	To understand the concept of Reasoning with Uncertainty & Probabilistic Reasoning
CO8	To Understand the basic forms of Machine Learning, decision trees and statistical Learning setting.

Course Contents:

Unit I:Introduction

AI History and applications. Overview of AI application areas: game playing, automated reasoning and theorem proving, expert systems, natural language understanding, planning and robotics, machine learning and Alan Turing Test.

Unit II: The Propositional and Predicate Logic

Symbol and sentences, the semantics of the Propositional Calculus & Predicate Calculus.Inference Rules and Theorem Proving.Axioms, Literals, Horn clause & Clausal forms.

Unit III: Reasoning

Inductive, Deductive, Abductive and Default reasoning. More examples on Resolution proof.

Unit IV: Problem Solving as Search

Structures and strategies for state space search. Algorithms for Heuristic search, Heuristic evaluation functions.

Unit V: Knowledge Representation

Knowledge representation Techniques; conceptual graphs; structured representations; frames, scripts; issues in knowledge representation: hierarchies, inheritance, exceptions.

Unit VI: Knowledge Elicitation and Knowledge Acquisition

An overview of the induction methods, types and tools.Stages in Knowledge acquisition with examples.Analyzing, coding, documenting and diagramming.Scope of knowledge.

Unit VII: Expert Systems

Overview of expert system technology; rule-based expert systems; Construction of ES.Components of an ES, The explanation facility, Rule-based formation and forward and backward chaining techniques for problem solving.

Unit VIII: Natural Language Processing

Introduction. Vocabulary and issues, How NLP programs work, Natural Language application, NL Interfaces.

Reference Books:

1. Artificial Intelligence - A New Synthesis by Nils J. Nilsson, Morgan Kaufmann Publishers.
2. Artificial Intelligence: Strategies and techniques for complex problems solving by George Luger, Addison-Wesley, 2003.
3. Artificial Intelligence - A Modern Approach by Stuart Russell & Peter Norvig, Prentice Hall.

Constitution of India

PCN 3079 **1 – 0 – 0 = NC**

Course Outcomes

CO1	Be aware of the basic principles of the Constitution of India
CO2	Know the their basic rights and duties
CO3	Understand the formation and functions of governance at different levels
CO4	Infuse the spirit of parliamentary democracy
CO5	Appreciate the relevance of special provisions in the Constitution

Course Contents:

- Historical Background
- Preamble
- States and Union territories
- Citizenship
- Fundamental Rights (FR)
- Fundamental Duties (FD)
- Directive Principles of State Policies (DPSP)
- Relation between FR, FD and DPSP
- Centre State Relationship
- President, Vice President, Prime Minister and other officials - I
- President, Vice President, Prime Minister and other officials - II
- Hindi as an official anguage
- Panchayats and Self Governance
- Emergency Provisions
- Amending the Constitution

Reference Books:

- Durga Das Basu, *Introduction to the Constitution of India* (21st edition), New Delhi: Lexis Nexis, 2013.
- Subhash C. Kashyap, *Our Constitution* (2nd edition), New Delhi: National Book Trust, India, 2011.
- Constitution of India online access: https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf

Mini Project –I

CSD 3001 **Credit= 3**

Course Contents:

Design/implementation work under the guidance of a faculty member. Prior to registration a detailed plan of work should be submitted by the student to the Director of the School for approval by faculty board.

Machine Learning

CSL 4107 **3– 0 – 0= 3**

Course Outcomes

CO1	Know the basics and mathematics behind various Machine Learning algorithms.
CO2	Think analytically and suggest possible solutions to problems using Machine Learning.
CO3	Know various programming tools to apply Machine Learning techniques into action.

Course Contents:

Unit 1:

1. Brief Introduction to Machine Learning
2. Supervised Learning
3. Unsupervised Learning
4. Reinforcement Learning

Unit 2:

1. Probability Basics
2. Linear Algebra
3. Statistical Decision Theory – Regression & Classification
4. Bias – Variance
5. Linear Regression
6. Multivariate Regression

Unit 3: Dimensionality Reduction

1. Subset Selection, Shrinkage Methods, Principle Components Regression
2. Linear Classification, Logistic Regression, Linear Discriminant Analysis
3. Optimization, Classification-Separating Hyperplanes Classification

Unit 4:

1. Artificial Neural Networks (Early models, Back Propagation, Initialization, Training & Validation)
2. Parameter Estimation (Maximum Likelihood Estimation, Bayesian Parameter Estimation)
3. Decision Trees
4. Evaluation Measures, Hypothesis Testing
5. Ensemble Methods, Graphical Models

Unit 5:

1. Clustering, Gaussian Mixture Models, Spectral Clustering
2. Ensemble Methods
3. Learning Theory, Reinforcement Learning

Reference Books:

- T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008.
- Christopher Bishop. Pattern Recognition and Machine Learning. 2e.

Machine Learning Lab

CSP 4107 **0– 0 – 2= 1**

List of experiments

NOTE: Use any of these programming language: Python/Octave/Matlab/R)

1. Explore the Weka tool and practice various pre-coded ML algorithms for regression, classification, clustering algorithms on the sample WEKA-datasets/UCI datasets.
2. Compute cost function for linear regression
3. Implement gradient descent for univariate linear regression
4. Compute cost function for multivariate linear regression
5. Implement gradient descent for multivariate linear regression
6. Given a UCI-Iris dataset (or any other dataset)code the classifier/clustering algorithm to:

predict the type (Iris-Setosa /Iris-Versicolor / Iris-Verginica) when given an input combination of: (sepal length, sepal width, petal length, petal width)

7. Cluster and visualize the data given in the Iris.xls based on Sepal Length.
8. Cluster and visualize the data given in the Iris.xls based on Sepal Width.
9. Cluster and visualize the data given in the Iris.xls based on Petal Length.
10. Cluster and visualize the data given in the Iris.xls based on petal Width.
11. Cluster and visualize the data based on Iris (types: Iris-Setosa /Iris-Versicolor / Iris- Verginica)

Soft Computing

CSL 3035 **3– 0 – 0= 3**

Course Outcomes

CO1	To understand the fundamental theory and concepts of neural networks, neuro-modelling, several neural network paradigms and its applications.
CO2	To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.
CO3	To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

Course Contents:

Unit I:Artificial Neural Network

Introduction – Fundamental concept – Evolution of Neural Networks – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network. Supervised Learning Network: Perceptron Networks – Adaline – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis Function Network.

Unit II

– Linear Separability – Hebb Network. Supervised Learning Network: Perceptron Networks – Adaline – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis Function Network.

Unit III:Fuzzy Set Theory Introduction to Classical Sets and Fuzzy sets

Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations – Noninteractive Fuzzy sets – Membership Functions: Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods.

Unit IV :Fuzzy Set Theory

Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning: Truth values and Tables in Fuzzy logic – Fuzzy Propositions – Formation of Rules – Decomposition and Aggregation of rules – Fuzzy Reasoning – Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

Unit V: (Genetic Algorithm) Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem – Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming. Applications of Soft Computing: A Fusion Approach of Multispectral Images with SAR Image for Flood Area Analysis – Optimization of Travelling Salesman Problem using Genetic Algorithm Approach – Genetic Algorithm based Internet Search Technique – Soft Computing based Hybrid Fuzzy Controllers – Soft Computing based Rocket Engine – Control.

Reference Books:

- S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007. ISBN: 10: 81-265-1075-7.
- S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 2003.

- Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997. 3. J.S.R.Jang, C. T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2004, Pearson Education.

Soft Computing Lab

CSP 3035 **0– 0 – 2= 1**

List of experiments

1. Design and simulate the behaviour of AND Gate using Perceptron Network in C for bipolar inputs and targets.
2. Design and simulate the behaviour of OR Gate using Adaline Network in C for bipolar inputs and targets.
3. Design and simulate the behaviour XOR Gate using Madaline network in C language for bipolar inputs and targets.
4. Design and simulate the behaviour of XOR gate using Back Propagation Network in c for Bipolar inputs and Binary targets.
5. Write a program in C to Implement the various primitive operations of classical sets.
6. Write a program in C to implement and verify various Laws associated with Classical sets.
7. Write a program in C to perform various primitive operations on Fuzzy Sets with Dynamic Components.
8. Write a program in C to verify various Laws associated with Fuzzy Sets.
9. Write a program in C to perform Cartesian product over two given Fuzzy Sets.
10. Write a program in C to perform Max-Min Composition of Two Matrices obtained from Cartesian Product.
11. Write a program in C to perform Max-Product Composition of Two Matrices obtained from Cartesian Product.
12. Write a program in C to maximize $F(X) = X^2$ using Genetic Algorithm where $0<X<31$

Software Engineering

CSL 3091 **3– 0 – 0 = 3**

Course Outcomes

CO1	Understanding the basics of Software Development Life Cycle and appreciating the complex process of Engineering an Industry Standard Software.
CO2	Appreciating the importance of a software process by understanding the already existing software process models.
CO3	Understanding the Software metrics, Project Planning, ISO & CMM standards.
CO4	Inculcating the ability to write a good quality SRS document, Design document. Ability to model the problem, designing solution through Data Flow Diagrams, Object Oriented Modeling, Use-cases etc.
CO5	Ability to Code & Test following industry standards for documentation and other best practices.
CO6	Usage of Industry standard tools like IBM Rational Software Architect during the entire life cycle of software building.

Course Contents:

Unit I: Introduction

The role of Software, Software Characteristics, Industrial strength software, Classification of software products, Legacy Software, Software Engineering Challenges, Software Development Life Cycle.

Unit II: Software Process

Software Development Process Models: Waterfall, Prototyping, Iterative, Spiral. Comparison of Models, Project Management Process, Inspection Process, Software Configuration management Process, Requirements Change management Process, Agile Process.

Unit III: Feasibility Study, Requirements Engineering & Analysis Modeling

Feasibility study: Technical, Economic & Behavioral; Data Gathering: Sources of Data, Observation, Interviewing, Questioners, On-site Observation, Software Process & Characteristics, Software Requirements, Problem Analysis: Data Flow Modeling, Object Oriented Modeling, Prototyping, Cost Benefit Analysis, SRS, Developing Use Cases. Validation & Metrics

Unit IV: Planning Software Projects

Effort Estimation: Constructive Cost Model (COCOMO), Project Scheduling, SCM planning, Quality Planning, Risk Management, Project Monitoring Planning

Unit V: Design Engineering

Design Concepts & Principles, Cohesion, Coupling, Design Methodology, Introduction to Unified Modeling Language (UML), Verification, Metrics

Unit VI: Coding & Testing

Programming principles, Coding Conventions, Coding process, Refactoring, Verification, Coding Metrics, Test Cases, Test Plan, White box & Black box testing, Unit Testing, Integration Testing, Validation Testing: Alpha & Beta Testing, System Testing, Debugging, Testing Metrics

Unit VII: Reliability, Quality & Maintenance

Software Reliability & Metrics, ISO 9000 Standard, Capability Maturity Model, CASE Tools, User Training, Software Maintenance

Reference Books:

- Software Engineering: A practitioner's Approach, Pressman,6th Ed., McGraw Hill
- System Analysis & Design, Elias M Awad
- Fundamentals of Software Engineering, Ghezzi, C ,PHI
- Managing the Software Process,W S Humphrey Addison–Wesley
- Ed. Encyclopedia of Software Engineering, Vols 1&2 , J JMarciniak, John Wiley
- Software Engineering, 5th Edition, Sommerville Ian Addison Wesley.
- Software Engineering , Manmdrioli, Dino
- Software Engineering: A programming Approach,3rd Edition, Bell, Douglas
- An integrated Approach to Software Engineering. ,Jalote, P ,Narosa Pub House

Software Engineering Lab

CSP 3091 **0– 0 –2 = 1**

Course Outcomes

List of Experiments:

1. Railway Commodity Reservation System
2. Multimedia Content Protection System
3. Delivery Agent System
4. Social Networking
5. Online Campus Security System
6. Airline Management System
7. Bus Service System
8. Hall Management System
9. Wallet Management System
10. Tournament Management System
11. Hospital Management System
12. Payroll Management System
13. Examination Management System
14. Smart Home Management System
15. Cyber Cafe
16. Graphics Editor System
17. Online Examination System
18. Toll Plaza System
19. Health Monitoring System
20. Security monitoring system

Phases in software development project

a) To assign the requirement engineering tasks
b) To perform the system analysis : Requirement analysis, SRS
c) To perform the function oriented diagram : DFD and Structured chart
d) To perform the user's view analysis : Use case diagram
e) To draw the structural view diagram : Class diagram, object diagram
f) To draw the behavioral view diagram : Sequence diagram, Collaboration diagram
g) To draw the behavioral view diagram : State-chart diagram, Activity diagram
h) To draw the implementation view diagram: Component diagram
i) To draw the environmental view diagram : Deployment diagram
j) To perform various testing using the testing tool unit testing, integration testing

Computer Network Security

CSL 4121 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Identify factors driving the need for network security
CO2	Identify and classify particular examples of attacks
CO3	Define the terms vulnerability, threat and attack
CO4	Identify physical points of vulnerability in simple networks
CO5	Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and the characteristics of hybrid systems

Course Contents:

UNIT 1

Introduction to cryptography and network security, Networks OSI Model of networking layers, Importance of Security in networks, types on internetwork, attacks, security services pervasive security mechanism.

UNIT 2

Foundation of Modern Cryptography, private key cryptography, DES, TDEA, Block Ciphers, linear cryptanalysis, differential cryptanalysis, AES public key Cryptography, DH algorithm, Algorithms for

discrete algorithms birth day paradox, pollard's p algorithm for discrete algorithm, EI Gomel public key, RSA, Elliptic curve cryptography, stream chippers

UNIT 3

Hashing Authentication & Signature Schemes Hashing schemes SHA- Family, MAC, Digital Signature RSA EI Gamel, DSS DSA Authentication Protocols, applications Kereberos X.509 Directory Services, E-mail security, Email architecture SSL PGP, MIME, S/MIME Internet Protocol Security (IPSec) IPSec architecture, IPSec verses other layers security, Mobile IPsec VPN Web Security, SSl, TLS, SETetc

UNIT 4

System Security Intruders, Types of Attacks, Protecting against Intruders, Honeypots, Scanning and analysis tools, Viruses and Worms, Types of Viruses, Protection, Firewall architecture implementing firewalls, XML firewalls, Trusted systems, Trusted system security implementation, wireless security.

Reference Books:

- Cryptography and Network Security: Behrouz A. Forauzan 2/e
- Cryptography and Network Security: William Stallings 4/e
- Cryptography and Network Security: AtulKahate 2/e

Nature Inspired Algorithms

CSL 4144 **3 –0– 0 = 3**

Course Contents:

Unit I: Introduction to Algorithms

Topic I: What is an algorithm, Newton's method, Formulation for optimization problems, Optimization algorithms, search for optimality, No-free lunch theorem, meta-heuristic algorithms

Topic II: Mathematical foundations: Norms, Eigen values, Eigen vectors, Sequences & Series, Convexity, Computational Complexity, Random Variables & Probability distributions

Unit II: Simulated Annealing

SA: Annealing & Boltzman distributions, SA Parameters, SA Algorithms, Convergence properties, Stochastic tunneling
Diiferential Evolution: Introduction, Diiferential Evolution, Variants, Choice of parameters, Convergence Analysis

Unit III: Particle Swarm Optimization

PSO Algorithm, Accelerated PSO, Implementation, Convergence Analysis, Binary PSO
Ant Colony Optimization: Algorithm, Implementation and convergence analysis

Unit IV: Nature Algorithms – I

Firefly Algorithm: Analysis, Implementation, Variants of Firefly algorithm, Applications, Why the Firefly is efficient
Cuckoo Search: Cuckoo Breeding behavior, levy flights, cuckoo search, implementation, variants of cuckoo search
Bat Algorithm: Analysis, Implementation, Binary BAT algorithm, Applications, Why the Bat is efficient

Unit V: Nature Algorithms – II

Grey-Wolf Algorithm: Analysis, Implementation, Variants of Grey-Wolf algorithm, Applications, Why the Grey-Wolf is efficient
Whale algorithm: Analysis, Implementation, Variants of Whale algorithm, Applications, Why the Whale is efficient
Flower Pollination algorithm: Implementaion, Multi-Objective FP Algorithm, Variants & applications

Reference Books:

1. Nature-Inspired Optimization Algorithms, Author: Xin-She Yang, Elsevier
2. Nature Inspired Algorithms and Their Applications, Wiley

Digital Image Processing

CSL 4091 **3– 0– 0 = 3**

Course Outcomes

CO1	Understand image formation for the acquisition of images.
CO2	Get broad exposure of the various applications of image processing in industry, medicine, agriculture
CO3	Get knowledge of existing algorithms for the processing of digital images.
CO4	Apply knowledge/skills to solve industrial problems based on image processing.
CO5	Think independently to evolve new methods and procedures with the analysis of image processing problems and techniques.

Course Contents:

Unit-1 Introduction and Digital Image Fundamentals

Application of Image Processing, Image Processing definition, steps in image Processing, Image Sensing and Acquisition, Image Sampling and Quantization, Spatial and Intensity resolution-Effect of reducing

spatial resolution, DPI, Effect of reducing image gray levels. Basic relationships between pixels and adjacency

Unit-2 Intensity Transformation and Spatial Filtering

Basics of intensity transformation and spatial filtering, intensity transformation functions- image negative, log transformation, power law; Piecewise-linear transformation functions- contrast stretching, intensity level slicing, bit plane slicing; Histogram Processing-histogram stretching, histogram equalization, Spatial Filtering, Spatial Correlation and Convolution, Smoothing Spatial Filters, order statistic filters, Sharpening Spatial Filters- The Laplacian, The Gradient-Robert cross gradient operator, Sobel operators

Unit-3 Image Restoration

Model of the image degradation/restoration process, Noise Models, Periodic Noise, Estimation of noise parameters, Restoration in the presence of noise-spatial filtering- Mean filters, Order-statistics filters, Median filter, Max and Min filters, Mid-point filter, Alpha-trimmed mean filter, adaptive filters.

Unit-4 Color Image Processing

Introduction to the color image processing, color models: RGB, HSI, CMY/ CMYK; Conversion of color models: converting colors from RGB to HSI, HSI to RGB, RGB to CMY and CMY to RGB etc. Pseudo coloring of images.

Unit-5 Image Compression

Introduction to image compression, need of compression, methods of image compression: coding redundancy, spatial and temporal redundancy, irrelevant information, models of image compression, Huffman coding, Arithmetic coding, LZW coding, run-length coding, block transform coding, JPEG compression, predictive coding

Unit-6 Image Segmentation

Fundamental, Point, Line and Edge detection, edge linking and boundary detection, Hough transform, thresholding, region-based segmentation, region splitting and merging

Reference Books:

- Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 3rd edition, Pearson Education.
- David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", Prentice Hall
- A.K. Jain, "Fundamental of Digital Image Processing", PHI
- W.K. Pratt, "Digital Image Processing

Digital Image Processing Lab

CSP 4091 **0– 0– 2 = 1**

List of Experiments:

1. Input a colored image and convert it into Black & White Image using Matlab Function.
2. Input an image and compare the effects of reduced Quantization levels to produce False Contouring.
3. Input an image and compare the effects of increased Quantization levels to produce Saturation affect.
4. Input an image and down-sample the image to a desired size.
5. Input an image an up-sample it to study the effect on image clarity.
6. Input an image and resize it to a desired size.
7. Write a code in Matlab to display the negative of an image.
8. Write a code in Matlab to improve the contrast of an image and compare the original and enhanced image.
9. Write a code in Matlab to observe thresholding (or extreme mage contrast).
10. Perform Gray level slicing on an image using both with and without background slicing techniques and compare the outputs.
11. Write a code in Matlab to hide a text in an input image and retrieve the same.
12. Write a Matlab code to improve the dynamic range of an input image using Log transformation or power law transformation.
13. Add Gaussian noise to an image and perform low –pass Average filtering on the image to study the effect.
14. Add salt & pepper noise to an image and perform Low-pass median filtering on it to analyse the effect.
15. Write a Matlab code to zoom an image using both replication as well as interpolation and compare the results.
16. Input an image and perform histogram stretching on it to see the resulting image.
17. Input an image to perform histogram equalisation on it and plot the resulting image to analyse the effect.
18. Perform masking on an input image using Sobel , Roberts and Prewitts operators.

Entrepreneurship Management

BUL4011 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Exposed to distinct entrepreneurial abilities, traits and capacity in an entrepreneurship portfolio
CO2	Exposed to the entrepreneurial environment prevailing in the world in general and India in particular.
CO3	Exposed to the process to select and screen business ideas and transcribe viable business plans
CO4	Exposed to the importance of innovation in the creation of sustainable competitive advantage.

Course Contents:

Unit-I

Meaning, definition and concept of enterprise, entrepreneurship and entrepreneurship Management; Evolution & theories of entrepreneurship; entrepreneurship development; resources and capabilities; socio-political & economic environment of entrepreneurship development; entrepreneurial strategies; entrepreneur v/s Intrapreneur.Entrepreneur Vs. entrepreneurship, entrepreneur vs. manager.Role of Entrepreneurship in Economic Development and factors affecting entrepreneurship.

Unit-II

Developing entrepreneurial competencies, entrepreneurial culture & entrepreneurial mobility; Entrepreneurial achievement motivation.Communications barriers and role of Government in promoting entrepreneurship. Financial support system, sources of financial support, MSME policies in India, agencies for policy formulation and implementation including SIDBI, Commercial Banks, SFCs. Forms of financial support, long-term and short-term financial support, development finance institutions, investment institutions. New Schemes for entrepreneurship development including Start-up India, Stand-up India, MUDRA Bank.

Unit-III

E-entrepreneurship; business models and strategies; venture capital financing, angel investors. Securing investors and structuring deals; creating the organization; corporate ventures and franchising; etc., Entrepreneurship and small business units, ancillary units, etc.Role and strategies of Government for the promotion of MSMEs. Contribution of training development programmes. Role of MSME sector in economic development of India Industrial policy of the states and country.

Unit-IV

Forms of business ownership, problems and opportunities.Steps involved in setting up a Business – identifying, selecting a good business opportunity, market survey and research. Techno-economic feasibility assessment; planning business process.Business plan formulation.

Unit-V

Project management -concept, features, classification of projects, Issues in project management, project identification and design and network analysis, project evaluation, planning &appraisal. Preparation of preliminary project reports, specimen of a project report. Emerging issues in the field of entrepreneurship management.

Reference Books:

- CharantimathP.M., 'Entrepreneurship Development in Small Business Enterprises', Pearson, 2007
- Singh B.N.P., 'Industrial Development under Structural adjustment Programme', D.D. Publication,2005
- David H. Holt, 'Entrepreneurship: New Venture Creation', Prentice – Hall of India Private Ltd., New Delhi, 2000.
- Drucker, P.F., 'Innovation and Entrepreneurship, Heinemann', London, 1985.
- Geoffrey G. Meredith, Robert E. Nelson, and Philip A. Neck, 'The Practice of Entrepreneurship', Sultan Chand & Sons, New Delhi, 1994.
- Gupta, A. Arora, S. and Mittal, S. 'Handbook of Business Plans', Excel Books, 2009.
- Kenneth, R., 'Entrepreneurship and Small Business Management', Harvard University Press, Boston, 1980.
- Marc J. Dollinger, 'Entrepreneurship: Strategies and Resources', Pearson Education, New Delhi, 2003.
- Norman M. Scarborough and Thomas W. Zimmerer,'Essentials of Entrepreneurship and Small Business Management', Prentice - Hall of India Private Ltd., New Delhi, 2006.
- Renu Arora and Dr. Sood S.K., 'Entrepreneurial Development', Kalyani Publishers, New Delhi, 2004.
- Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, 'Entrepreneurship', Tata McGraw Hill Education Private Limited, New Delhi, 2007.
- Schumpeter, J., The Theory of Economic Development, Harvard University Press, Harvard, 1954.
- Economic and Political Weekly, New Delhi,Various Issues.

(Major Project + **Open Elective-III-NC**) / Internship

CSD 4100/ CSC 4083 **Credits = 10**

Course Outcomes

CO1	Undertake/Identify an engineering problem and designing/implementing its solution
CO2	Demonstrate sound technical knowledge learnt during the Engineering program.
CO3	Demonstrate the ability to learn new technologies through the selected problem
CO4	Learning to communicate with other professionals through formal presentations and Professional Quality Project Reports
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.

Software Defined Networking

CSE 3028 **2 – 0 – 2 = 3**

Course Outcomes

CO1	Understand the fundamentals of SDN
CO2	Understand the characteristics of SDN controllers and their implications
CO3	Apply SDN programming tools and approaches for programming of SDN
CO4	Understand the key SDN applications, security of SDN and Network Function Virtualization (NFV)
CO5	Understand the design and implementation techniques for SDN.

Course Contents:
History and Evolution of Software Defined Networking (SDN): Separation of Control Plane and Data Plane, IETF Forces, Active Networking.

Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the OpenFlow protocol.

Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework (VMWare and others), Mininet based examples.

Control Plane: Overview, Existing SDN Controllers including Floodlight and OpenDaylight projects.

Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts.

Data Plane: Software-based and Hadrware-based; Programmable Network Hardware.

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.

Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies.

Use Cases of SDNs: Data Centers, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.

Programming Assignmen
ts for implementing some of the theoretical concepts listed above

Reference Books:

- SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10: 1-4493-4230-2.
- Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844
- SDN and OpenFlow for Beginners by Vivek Tiwari, Sold by: Amazon Digital Services, Inc., ASIN: , 2013.
- Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
- Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015.
- OpenFlow standards, http://www.openflow.org, 2015.
- Online Reading Lists, including: http://www.nec-labs.com/~lume/sdn-reading-list.html, 2015.

Storage Networks

CSE 3072 **3 – 0 – 0 = 3**

Course Outcomes

CO1	To Learn about the data generation sources and identification of Storage devices
CO2	To learn about different storage devices like NAS, DAS, SAN and CAS
CO3	To help business organizations to identify their storage requirements, I/O's and security of data
CO4	To understand the need of Virtualization and ILM

Course Contents:

UNIT 1: Introduction to Storage Technology
Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations

UNIT-II: Storage Systems Architecture
Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure- components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols

UNIT-III:Introduction to Networked Storage
JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fibre Channel principales, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity protocols (NFS, CIFS, ftp), & management principles, IP SAN elements, standards (iSCSI, FCIP, iFCP), connectivity principles, security, and management principles, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage solutions overview including technologies like virtualization & appliances.

UNIT-IV:Introduction to Information Availability
Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques

UNIT-V:Managing & Monitoring
Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and pro-active management best practices, Provisioning & configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview

UNIT-VI:Security & Virtualization
Storage Security (Importance of Information security, elements and attributes of security), Developing a storage security model (Restricting Access Path, Vulnerability Management, Understanding Vulnerabilities), Securing Data Storage (Storage Security domains, Risk assessment Methodology, Security elements, threats against applications, Controlling user access to data, threats again backup , recovery and archive) Virtualization (Define virtualization, types of virtualization), Storage Virtualization (Storage functionality, Virtual storage, Comparison of virtualization architectures, challenges of storage virtualization), Block level virtualization, File level virtualization.

Reference Books:

- Robert Spalding: "Storage Networks the Complete Reference", Tata McGraw-Hill, 2011.
- Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
- Richard Barker and Paul Massiglia: "Storage Area Network Essentials "A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.
- Information Storage and Management by EMC Corporation.

Neural Networks & Fuzzy Set

CSE 4102 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Comprehend the fundamentals and types of neural networks.
CO2	Comprehend and analyse the concepts of various feed forward and feedback neural networks.
CO3	Comprehend and obtain the broad knowledge in developing the different algorithms for Neural networks.
CO4	Obtain broad knowledge of Fuzzy Logic principles and understand the concept of fuzziness involved in various systems and fuzzy set theory.
CO5	Learn and comprehend the methods of Fuzzification and Defuzzifications.

Course Contents:

Unit I

Artificial Neural Network

Introduction – Definition, Application Scope of Neural Networks, Fuzzy Logic-Introduction, Definition, Application Scope of Fuzzy Logic and Fuzzy Set, Hybrid Systems, Neuro-Fuzzy systems, Introduction to Soft Computing.

Unit II

Artificial Neural Network

Fundamental concept of Artificial Neural Network, Biological Neural Network, comparison between biological and Artificial Neural Network, Evolution of Neural Networks – Basic Models of Artificial Neural Networks – Connection, Learning, activation functions, Important Terminologies of ANNs, McCulloch-Pitts Neuron –Theory, architecture, Linear Separability, Hebb Network-Theory, Flowchart of Training Algorithm, Training Algorithm.

Unit III

Artificial Neural Network

Supervised Learning Network: Perceptron Networks – Perceptron Learning Rule, Architecture, flowchart for training process, training algorithm for single Output Class, Training Algorithm for Multiple Output Class, Examples, Adaline – Learning Rule, Architecture, flowchart for training process, training algorithm for single Output Class, Training Algorithm for Multiple Output Class, Examples, Multiple Adaptive Linear Neurons – Learning Rule, Architecture, flowchart for training process, training algorithm for single Output Class, Training Algorithm for Multiple Output Class, Examples, Back-Propagation Network – Learning Rule, Architecture, flowchart for training process, training algorithm for single Output Class, Training Algorithm for Multiple Output Class, Examples, Radial Basis Function Network.

Unit IV

Fuzzy Set Theory Introduction to Classical Sets and Fuzzy sets

Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations – Noninteractive Fuzzy sets – Membership Functions: Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods.

Unit V

Fuzzy Set Theory

Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning: Truth values and Tables in Fuzzy logic – Fuzzy Propositions – Formation of Rules – Decomposition and Aggregation of rules – Fuzzy Reasoning – Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

Reference Books:

1. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007. ISBN: 10: 81-265-1075-7.
2. S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 2003.
3. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997. 3. J.S.R.Jang, C. 4. T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2004, Pearson Education.

Data mining & warehousing

CSE 3082 **3 – 0 – 0 = 3**

Course Outcomes

CO1	To understand data warehouse concepts, architecture, business analysis and tools
CO2	To understand data pre-processing and data visualization techniques
CO3	To study algorithms for finding hidden and interesting patterns in data
CO4	To understand and apply various classification and clustering techniques using tools.

Course Contents:

Module - I

Data Mining : Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

Module - II

Data Warehouse : Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data warehousing to Data Mining.

Module - III

Data Processing : Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept Hierarchy Generation. Data Mining Primitives, Languages and System Architecture : Data Mining Primities, DMQL, Architectures of Data Mining Systems.

Module – IV

Concept Description : Data Generalization & Summarization – Based Characterization, Analytical Characterization, Mining class Comparisons, Mining Descriptive Statistical Measures in Large Databases.

Module - V

Mining Association Rules in Large Databases : Association Rule Mining, Single – Dimensional Boolean Association Rules, Multilevel Association Rules from Transaction Databases, Multi Dimensional Association Rules from Relational Databases, From Association Mining to Correlation Analysis, Constraint – Based Association Mining.

Module - VI

Classification and Prediction : Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on concepts & Association Rule, Other Classification, Prediction, Classification Accuracy.

Module - VII

Cluster Analysis : Types of Data in Cluster Analysis, Partitioning methods, Hierarchical methods, Density – Based Methods, Grid – Based Methods, Model – Based Clustering Methods, Outlier Analysis.
Mining Complex Types of Data.

Reference Books:

1. Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques Publisher Harcout India. Private Linited.
2. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006.
3. A. Berson& S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004
4. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006.

Block Chain Coding

CSL 3583/CSE 3583 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Know the Basic concepts, Design, Architecture, Mining, Network and Security aspects of a Block chain & Crypto currency.
CO2	Know the basics of the languages used in building Block chain & Smart Contracts.
CO3	Understand the application of Block chain in various other domains like Smart Contracts, IoT, Business Process Management etc.

Course Contents:

Unit 1

Introduction to Bit coin, Basic concepts about: Transactions, Transaction Blocks, Blockchain, Mining, Bitcoin Addresses, Wallet technology, Transaction inputs and outputs, Transaction Script, Digital Signature, Advanced Concepts in Transactions and scripting.

Unit 2

The Bit coin Network: Peer to Peer Network Architecture, Full Nodes and SPV Nodes, Encryption and authentication in connections, Transactions Pool, Structure of Block, Block Header, Block Header Hash and Height, Genesis Block, Markle Trees, Linking Blocks in chains.

Unit 3

Mining and Decentralized consensus, Aggregating Transactions in Blocks, Mining the Block, Validating Block, Mining and the Hashing Race, Consensus Attacks, Bit coin Security principles and best practices, Block Chain Applications.

Unit 4

Introduction to Hyper ledger-Fabric/Ethereum for building distributed ledgers (blockchain), Smart contracts, decentralized blockchain applications.

Reference Books:

- Mastering Bitcoin – Programming the Open Blockchain, 2nd Edition by Andreas M Antonopoulos, O'Reilly Publications
- Building Blockchain Projects: Building decentralized Blockchain applications with Ethereum and Solidity, by Narayan Prusty, Packt publications
- Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer, by Nitin Gaur, Packt publications
- Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, by Imran Bashir, Packt Publications
- Blockchain: Blueprint for a New Economy, 1st Edition, by Melanie Swan, O'Reilly publications
- Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits

Cloud Computing

CSE 4152 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the architecture and different types of clouds
CO2	Case studies of different cloud servers
CO3	Understanding popular cloud platforms and creating virtual machines

Course Contents:

Unit I: Cloud Computing Fundamental: Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.

Unit II: Cloud Applications: Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages
Unit III: Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics : Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)
Unit IV: Application Development: Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.
Reference Books:

- Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN: 978-0521137355]
- Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach [ISBN: 0071626948]
- Dimitris N. Chorafas, Cloud Computing Strategies [ISBN: 1439834539]

Parallel & Distributed Computing

CSE 4151 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the requirements for programming parallel systems and how they can be used to facilitate the programming of concurrent systems.
CO2	To learn and apply knowledge of parallel and distributed computing techniques and methodologies
CO3	Understand the memory hierarchy and cost-performance tradeoffs.

Course Contents:
Classification of parallel computing structures, instruction level parallelism - static and dynamic pipelining, improving branch performance, superscalar and VLIW processors; High performance memory system; Shared memory multiprocessors and cache coherence; Multiprocessor interconnection networks; Performance modelling; issues in programming multiprocessors; Data parallel architectures. Models of distributed computing; Basic issues; Causality, Exclusion, Fairness, independence, Consistency; Specification of DIstributted Systems; Transition systems, Petri nets, process algebra properties; Safety, Liverness, Stability.

Reference Books:
• Advanced Computer Architecture, Kai Hwang

Deep Learning

CSE 6036 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Explain different network architectures and how these are used in current applications
CO2	Implement, train, and evaluate neural networks using existing software libraries
CO3	Present and critically assess current research on neural networks and their applications
CO4	Relate the concepts and techniques introduced in the course to your own research
CO5	Plan and carry out a research project on neural networks within given time limits

Course Contents:
Unit 1:
Introduction to Machine Learning, Supervised Learning, Unsupervised Learning, Examples and Applications of Supervised Learning, Examples and Applications of Unsupervised Learning, Classification Algorithms: Naïve Bayesian Classifiers, Decision Tree, Random Forest
Unit 2:
Classification Algorithms: K-NN and other algorithms, Regression Algorithms: Linear and Logistic Regression, Unsupervised Algorithms: Clustering algorithms, Association Rule Mining algorithms
Unit 3:
History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks
Unit 4:
Backpropagation, Gradient Descent (GD), Autoencoders, Regularization in autoencoders, Denoisingautoencoders, Sparse autoencoders, Contractive autoencoders, Deep Belief Networks (DBN), Restricted Boltzman Machine (RBM), Regularization: Bias Variance Tradeoff, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods
Unit 5:
Convolutional Neural Networks, Recurrent Neural Networks, Backpropagation through time (BPTT), LSTMs (Long Short Term Memory Neural Networks

Reference Books:
•Deep Learning, An MIT Press book, Ian Goodfellow and YoshuaBengio and Aaron Courville

- http://www.deeplearningbook.org

Advanced Computer Architecture

CSE 4062 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the Concept of Parallel Processing and its applications
CO2	Implement the Hardware for Arithmetic Operations
CO3	Analyze the performance of different scalar Computers
CO4	Develop the Pipelining Concept for a given set of Instructions
CO5	Distinguish the performance of pipelining and non pipelining environment in a processor

Course Contents:

Unit-I:Overview of Parallel Processing and Pipelining Processing, study and comparison of uni-processors and parallel processors. Conventional and EPIC architecture.Evolution of parallel processors, future trends and there architecture. Overview of Parallel Processing and Pipelining Processing Necessity of high performance, Constraints of conventional architecture, Parallelism in uni-processor system, Evolution of parallel processors, future trends, Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture, Case study of Intel Itanium Processor. Principles of scalable performance: Performance Metrics and Measures, Speedup Performance Laws. Programming aspects for Intel Itanium Processor

Unit-II: Principles and implementation of Pipelining, Classification of pipelining processors, Pipeline Architecture, Study and comparison of processors with and without pipelining. General pipelining reservation table, Design aspect of Arithmetic and Instruction pipelining, Pipelining hazards and resolving techniques, Data buffering techniques, Job sequencing and Collision, Advanced pipelining techniques, loop unrolling techniques, out of order execution, software scheduling, trace scheduling, Predicated execution, Speculative loading, Register Stack Engine, Software pipelining, VLIW (Very Long Instruction Word) processor, Case study: Super scalar Architecture- Pentium, Ultra SPARC. Super scalar architecture of Pentium, Ultra SPARC, Advances in pipeline architectures. Implementation issues of a program on any pipelined processor their analysis.

Unit-III: Study and comparison of Vector and array processors, Vector and Array Processor, Basic vector architecture, Issues in Vector Processing, Vector performance modeling, vectorizers and optimizers, Case study: Cray Arch. SIMD Computer Organization Masking and Data network mechanism, Inter PE Communication, Interconnection networks of SIMD, Static Vs Dynamic network, cube hyper cube and Mesh Interconnection network. Parallel Algorithms For Array Processors: Matrix Multiplication. Sorting, SIMD computer organization. Implementation issues of Matrix multiplication and sorting on array processor and their analysis.

Unit-IV: Microprocessor Architectures, study and comparison of Loosely and Tightly coupled multiprocessors.Loosely and Tightly coupled multiprocessors, Processor characteristics of multiprocessors, Inter Processor communication network, Time shared bus, Crossbar switch, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency and bus snooping, Massively Parallel Processors (MPP), Cow's and NOW's Cluster and Network of Work Stations), Chip Multiprocessing (CMP), Case Study of IBM Power4 Processor Inter Processor Communication and Synchronization, Implementation issues of a program on multiprocessor system.

Unit-V: Study of Architecture of Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions. Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Message passing parallel programming, Shared Memory Programming, Data Parallel Programming. Implementation issues of a multithreaded program.

Unit-VI: Parallel software issues, study of parallel programming concepts. a)Parallel algorithms for multiprocessors, classification of parallel algorithms, performance of parallel algorithms b) Operating systems for multiprocessors systems, Message passing libraries for parallel programming interface, PVM (in distributed memory system), Message Passing Interfaces (MPI), Threads (in shared memory system) c) Parallel Programming Languages : Fortran 90, Occam, C-Linda, CCC etc. d) Issues towards cluster computing. Introduction to Neuro Computing and Grid Computing:

Reference Books:

- Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill international Edition
- Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill
- V.Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI.
- William Stallings, "Computer Organization and Architecture, Designing for performance" Prentice Hall, Sixth edition.
- Kai Hwang, Scalable Parallel Computing.
- Harrold Stone, High performance computer Architecture.
- Richard Y. Kain, Advanced Computer Architecture
- http://www.intel.com/products/processor (for Intel Itanium Processor)

High Performance Computing

CSE 4223 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Describe and use the main design techniques for sequential and parallel algorithms
CO2	Design, prove the correctness and analyze the computational complexity of sequential and parallel algorithms
CO3	Understand the differences among parallel and sequential algorithms solving the same problem and recognize which one is better under different conditions
CO4	Understand parallel algorithm for different architectures
CO5	Describe and use basic and advanced parallel algorithms.

Course Contents:

Unit-I:

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

Unit-II:

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Costoptimality, An example of illustrate Cost-optimal algorithms- such as summation, Min/Max on various models.

Unit-III:

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting Networks on CREW/EREW/MCC/, linear array

Unit-IV:

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

Unit-V:

Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, Combinations, Derrangements.

Reference Books:

- M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer" by Mc Graw Hill.
- S.G. Akl, "Design and Analysis of Parallel Algorithms"
- S.G. Akl, "Parallel Sorting Algorithm" by Academic Press

Internet of Things

CSE 3109 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the vision of IoT from a global context.
CO2	Understand and identify the areas for requirements of applications of IoT.
CO3	Determine the Market perspective of IoT.
CO4	Use of Devices, Gateways and Data Management in IoT.
CO5	Develop applications of IoT in Industrial and Commercial and Real World Design Constraints.

Course Contents:

Unit I: Introduction

What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks :IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities

Unit II: Fundamental IOT Mechanisms and Key Technologies

Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology

Unit III: Radio Frequency Identification Technology

RFID: Introduction, Principle of RFID, Components of an RFID system, Issues

EPCGlobal Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things.

Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication

WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

Unit IV: Resource Management in The Internet Of Things

Clustering, Software Agents, Clustering Principles in an Internet of ThingsArchitecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization.

Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust.

Unit V: Internet of Things Privacy, Security and Governance

Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non repudiation and availability, Security model for IoT.

Unit VI: Business Models For The Internet Of Things

Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things.

Unit VII: Internet of Things Application

Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards

Reference Books:

- Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
- Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
- Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).

Human Computer Interaction

CSE 4142 **3 – 0 – 0 = 3**

Course Contents:

Introduction: Course objective and overview, Historical evolution of the field ofHuman Computer Interaction (HCI)

Interactive system design : Concept of usability - definition and elaboration, HCI and software engineering, GUI design and aesthetics, Prototyping techniques.

Model-based Design and evaluation: Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Fitts' law and HickHyman's law, Model-based design case studies.

Guidelines in HCI: Shneiderman's eight golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough.

Empirical research methods in HCI: Introduction (motivation, issues, research question formulation techniques), Experiment design and data analysis (with explanation of one-way ANOVA)

Task modeling and analysis: Hierarchical task analysis (HTA), Engineering task models and Concur Task Tree (CTT).

Dialog Design: Introduction to formalism in dialog design, design using FSM (finite state machines), State charts and (classical) Petri Nets in dialog design.

Cognitive architecture: Introduction to CA, CA types,relevance of CA in IS design, Model Human Processor (MHP)

Object Oriented Programming: OOP- Introduction, OOM- Object Oriented Modeling of User Interface Design

Design -Case Studies: Case Study 1- MultiKey press Hindi Text Input Method on a Mobile Phone, Case Study 2 - GUI design for a mobile phone based Matrimonial application, Case Study 3 - Employment Information System for unorganised construction workers on a Mobile Phone

References:

Dix A., Finlay J.,Abowd G. D. and Beale R. Human Computer Interaction, 3 rd edition, Pearson Education, 2005.

Preece J., Rogers Y.,Sharp H.,Baniyon D., Holland S. and Carey T. Human Computer Interaction,Addison-Wesley, 1994.

B.Shneiderman; Designing the User Interface,Addison Wesley 2000 (Indian Reprint).

https://nptel.ac.in/courses/106/103/106103115/

Quantum Computing

CSE 3080 **3 – 0 – 2 = 4**

Course Outcomes

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

- Explain the working of a Quantum Computing program, its architecture and program model
- Develop quantum logic gate circuits
- Develop quantum algorithm
- Program quantum algorithm on major toolkits

Course Contents:

1. Introduction to Quantum Computing (6 Hours)
   - 1.1 Motivation for studying Quantum Computing
   - 1.2 Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.)
   - 1.3 Origin of Quantum Computing
   - 1.4 Overview of major concepts in Quantum Computing
     - •Qubits and multi-qubits states, Bra-ket notation.
     - • Bloch Sphere representation
     - • Quantum Superposition

- Quantum Entanglement

2. Math Foundation for Quantum Computing (9 Hours)

2.1 Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.

3. Building Blocks for Quantum Program (8 Hours)

3.1 Architecture of a Quantum Computing platform

3.2 Details of q-bit system of information representation:

- Block Sphere
- Multi-qubits States
- Quantum superposition of qubits (valid and invalid superposition)
- Quantum Entanglement
- Useful states from quantum algorithmic perceptive e.g. Bell State
- Operation on qubits: Measuring and transforming using gates.
- Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc.

3.3 Programming model for a Quantum Computing Program

- Steps performed on classical computer
- Steps performed on Quantum Computer
- Moving data between bits and qubits.

4. Quantum Algorithms (22 Hours)

4.1 Basic techniques exploited by quantum algorithms.

- Amplitude amplification
- Quantum Fourier Transform
- Phase Kick-back
- Quantum Phase estimation
- Quantum Walks

4.2 Major Algorithms

- Shor's Algorithm
- Grover's Algorithm
- Deutsch's Algorithm
- Deutsch -Jozsa Algorithm 4.3 OSS Toolkits for implementing Quantum program
- IBM quantum experience
- Microsoft Q
- RigettiPyQuil (QPU/QVM)

LIST OF PRACTICALS

1. Building Quantum dice
2. Building Quantum Random No. Generation
3. Composing simple quantum circuits with q-gates and measuring the output into classical bits.
4. Implementation of Shor's Algorithms
5. Implementation of Grover's Algorithm
6. Implementation of Deutsch's Algorithm
7. Implementation of Deutsch-Jozsa's Algorithm
8. Mini Project such as implementing an API for efficient search using Grover's Algorithms or Integer factorization using Shor's Algorithm

LIST OF SUGGESTED BOOKS

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley
3. IBM Experience: https://quantumexperience,ng,bluemix.net
4. Microsoft Quantum Development Kit https://www.microsoft.com/en-us/quantum/development-kit
5. Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/

Wireless Network

CSE 3074 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Basic understanding of Wireless Sensor Network
CO2	Media access control in ad hoc and sensor networks Network and transport layer issues for ad hoc and sensor networks
CO3	Design and implementation of wireless network application and build their own protocols.
CO4	Implementation of different protocols in different platform like mobile application and desktop.

Course Contents:

Introduction: What is an Ad Hoc Network?, Types of Ad hoc Mobile Communications , Types of Mobile Host Movements, Challenges Facing Ad hoc Mobile Networks, Ad hoc wireless Internet, Issues in

Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols: Table–Driven Routing Protocols, Destination Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP), Cluster Switch Gateway Routing (CSGR), Source–Initiated On–Demand Approaches, Ad hoc On–Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), Signal Stability Routing (SSR), Location–Aided Routing (LAR), Power–Aware Routing (PAR), Zone Routing Protocol (ZRP).
Wireless Sensor Networks: Introduction to Wireless sensor networks, Single-sink single-hop WSN, Single-sink multi-hop WSN, Multi-sink multi-hop WSN, Advantages of ad-hoc/sensor networks, Node and Network Architectures, Wireless Sensor Device Architecture, Network Architectures, Main features of WSANs, Current and future research on WSANs, **Applications of WSNs**
Technologies for WSNs: ZigBee technology, Ultrawide bandwidth technology, Bluetooth technology, Comparison among technologies.WIMAX, 4G technology
Communication protocols for WSNs

MAC protocols and Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Flat routing, Flooding and gossiping, SPIN protocol, Directed diffusion protocol, Rumour routing, Gradient-based routing, Hierarchical routing, LEACH protocol, PEGASIS protocol, TEEN protocol, MECN protocol, SPAN protocol, Location-based routing protocols, Contention-based protocols.
Case Studies: Simulation of a Sensor Network

Reference Books:

- Roberto Verdone, DavideDardari, Gianluca Mazzini and Andrea Conti, "Wireless Sensor and Actuator Networks: Technologies, Analysis and Design", Academic Press, 2008.
- Miguel A. Labrador and Pedro M. Wightman, "Topology Control in Wireless Sensor Networks-with a companion simulation tool for teaching and research", Springer Science, 2009.
- AzzedineBoukerche, "Handbook of Algorithms for Wireless Networking and Mobile Computing", Chapman & Hall/CRC, 2005.

Information Coding Practices

CSE 4012 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understands the fundamentals of coding theory
CO2	Understands concept of source coding.
CO3	Understands channel coding theorem.

Course Contents:
UNIT 1 Mathematical Background and Introduction
Introduction to algebraic structures, Field extensions, Quadratic Residues, Krawtchouk Polynomials, Combinatorial Theory, Probability Theory, Shannon's Theorem, Coding Gain, Problems.
UNIT 2 Linear and Good Codes
Block Codes, Linear codes, Hamming codes, Majority Logic decoding, Weight enumerators, The Lee Metric, Hadamard codes and generalizations, Binary Golay code, The Ternary Golay code, Constructing codes from other codes, Reed-Muller codes, Kerdock codes
UNIT 3 Bounds on Codes and Cyclic Codes
Gilbert bound, Asymptotic Plotkin bound, Griesmer bound, The Linear Programming bound, Cyclic codes, Zeros of a Cyclic codes, The Idmpotent of a cyclic codes, Other representations of a Cyclic codes.

Reference Books:

- Introduction to Coding Theory, J. H. Van Lint

Computer Embedded Systems

CSE4054 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Foster ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
CO2	Foster ability to write the programs for microcontroller.
CO3	Foster ability to understand the role of embedded systems in industry
CO4	Foster ability to understand the design concept of embedded systems.

UNIT 1 Product Specification (7 Contact Periods)
Hardware / Software partitioning – Detailed hardware and software design –Integration –Product testing Selection Processes, Microprocessor Vs Micro Controller, Performance tools Bench marking RTOS Micro Controller, Performance tools, Bench marking, RTOS availability,Tool chain availability, Other issues in selection processes.
UNIT 2Partitioning Decision (8 Contact Periods)

Hardware / Software duality – coding Hardware – ASIC revolution Managing the Risk –Co-verification – execution environment – memory organization – System startup –Hardware manipulation – memory mapped access – speed and code density.

Unit 3 Interrupt Service Routines (7 Contact Periods)

Watch dog timers – Flash Memory basic toolset – Host based debugging – Remote debugging – ROM emulators – Logic analyser – Caches – Computer optimisation –Statistical profiling

Unit 4In Circuit Emulators (6 Contact Periods)

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

Unit 5 Testing (6 Contact Periods)

Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

Reference Books:

- Arnold S. Berger – "Embedded System Design", CMP books, USA 2002.
- SriramIyer, "Embedded Real time System Programming"
- ARKIN, R.C., Behaviour-based Robotics, The MIT Press, 1998.

Multimedia And Virtual Reality

CSE4090 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Graduate will demonstrate an ability to do research by designing and conducting experiments, analyze and interpret multimedia data individually as well as part of multidisciplinary teams.
CO2	Graduates will demonstrate an ability to design a system, component or process as per needs and specifications of the customers and society needs.
CO3	Graduates will demonstrate an ability to prepare short films and documentaries to showcase their knowledge of multimedia tools.

UNIT 1 Multimedia preliminaries and applications (9 Contact Periods)

Multimedia preliminaries and applications: Development and use of multimedia packages; introduction to virtual reality and modeling languages. CD-ROM and the Multimedia Highway, Introduction to making multimedia - The Stages of project, the requirements to make good multimedia, Multimedia skills and training, Training opportunities in Multimedia. Motivation for multimedia usage, Frequency domain analysis, Application Domain & ODA etc. Multimedia-Hardware and Software: Multimedia Hardware – Macintosh and Window production Platforms, Hardware peripherals – Connections, Memory and storage devices, Media software – Basic tools, making instant multimedia, Multimedia software and Authoring tools, Production Standards.

UNIT 2 Multimedia building blocks (7 Contact Periods)

Multimedia – making it work – multimedia building blocks – Text, Sound, Images, Animation and Video, Digitization of Audio and Video objects, Data Compression: Different algorithms concern to text, audio, video and images etc., Working Exposure on Tools like Dream Weaver, 3D Effects, Flash Etc.

UNIT 3 Multimedia and the Internet (7 Contact Periods)

Multimedia and the Internet: History, Internet working, Connections, Internet Services, The World Wide Web, Tools for the WWW – Web Servers, Web Browsers, Web page makers and editors, Plug-Ins and Delivery Vehicles, HTML, Designing for the WWW – Working on the web, Multimedia Applications – Media Communication, Media Consumption, Media Entertainment, Media games.

UNIT 4 Multimedia-looking towards Future (6 Contact Periods)

Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing, Assembling and delivering a project-planning and costing, Designing and Producing, content and talent, Delivering, CD-ROM technology.

Reference Books:

- Steve Heath, 'Multimedia and Communication Systems' Focal Press, UK.
- Tay Vaughan, 'Multimedia: Making it Work', TMH
- Keyes, 'Multimedia Handbook', TMH

High Performance Computing

CSE4223 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Describe and use the main design techniques for sequential and parallel algorithms
CO2	Design, prove the correctness and analyze the computational complexity of sequential and parallel algorithms
CO3	Understand the differences among parallel and sequential algorithms solving the same problem and recognize which one is better under different conditions
CO4	Understand parallel algorithm for different architectures
CO5	Describe and use basic and advanced parallel algorithms

Course Contents:

Unit-I:

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

Unit-II:

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost optimality, An example of illustrate Cost-optimal algorithms- such as summation, Min/Max on various models.

Unit-III:

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting Networks on CREW/EREW/MCC/, linear array

Unit-IV:

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

Unit-V:

Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, Combinations, Derrangements.

Reference Books:

- M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer" by Mc Graw Hill.
- S.G. Akl, "Design and Analysis of Parallel Algorithms"
- S.G. Akl, "Parallel Sorting Algorithm" by Academic Press

Cyber Security

CSE 3122 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Student should understand cyber-attack, types of cybercrimes, cyber laws and also how to protect them self and ultimately society from such attacks
CO2	Hands-on experience with cyber-attacks using kali linux based operating system.
CO3	Understand the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
CO4	Understand the Indian IT Act 2000 that govern electronic commerce activities, different types of cybercrime and apply critical thinking in analysing judicial decision related to e-commerce cybercrimes.

Course Contents:

Introduction

Terminologies : cyberspace, cybercrime, cyber security, Cyber squatting, cyberpunk, cyber warfare, cyber terorrism, Cyber security needs, Cyber criminals : Introduction, Cybercriminals Groups, Classification of cyber crimes, Cybercrime categories, Cybercrime : The legal perspective

Cyber offenses

Hackers, crackers, phreakers : Introduction, Planning cybercrime, Social engineering Cyberstalking, Cybercafe and cybercrime, Attack vector, Botnets

Cybercrime techniques

Proxy servers and Anonymizers, phishing, Password cracking, Keyloggers and spywares, Virus and worms, Trojan horse and backdoors, Steganography, Dos and DDosattacks,SQL injection, Buffer overflow

Phishing and Identity theft

Phishing : Introduction, Phishing methods : Dragnet, Rod-and-reel , Lobsterpot, Gillnet, Techniques of phishing, Phishing Toolkits and Spy Phishing, Phishing countermeasures, Personally Identifiable Information (PII),Types of Identity theft, Techniques of Identity theft, Identity Theft Countermeasures

Legal Perspective of Cyber security & Forensics fundamentals

Need for cyber laws: The Indian context, Indian IT Act 2000,Changes made in IT Act 2000, Digital signatures and the Indian IT Act, Cybercrime and punishment, Cyberforensics : introduction, types, Needs of cyber forensics, Cyberforensics and digital evidence

Cyber Security: Organization Implications

Search Breach: PI Collecting by Organization, Insiders threats in Organization,PrivacyDimension,Key-challenges in Organization,Cost of cyber crimes and IPR issues,Organizational guidelines for Internet usage, safe computing guidelines and computer usage policy,Forensics best practices for organization

Recommended Books:

1. Marjie T. Britz Computer Forensics and Cyber Crime: An Introduction, Pearson
2. AlfaredBasta and Wolf Holten, Computer Security Concepts, Issues and Implementation, CENGAGE learning

3. Raghu Santanam, M. Sethumadhavan, MohitVirendraCyber Security, Cyber Crime and Cyber Forensics, IGI Global
4. George M. Mohay,AlisonAndersonComputer and intrusion forensics, Artech House

E-Commerce & Cyber Laws

CSE 4016 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Demonstrate an understanding of the foundations, importance, types and the technical infrastructure requirement of E-commerceand E-business.
CO2	Understand the components of Business model, importance of business models in E-commerce and analyse the impact of E-commerce on business models and strategy.
CO3	Recognize and discuss the E-commerce issues like data privacy and security and various solutions to achieve the privacy and security in e-commerce.
CO4	Understand and assess electronic prepaid and post-paid payment systems for e-commerce.
CO5	Understand the Indian IT Act 2000 that govern electronic commerce activities, different types of cybercrime and apply critical thinking in analysing judicial decision related to e-commerce cybercrimes.

Course Contents:

Unit-1- Introduction to E-commerce

Define E-commerce, Brief history of E-commerce, Forces fueling E-commerce, Challenges to traditional methods, Types of E-commerce, E-Business, E business trident, E-com Vs E-Business.

Unit-2 E-Commerce Challenges and Issues

E-commerce Challenges, E-commerce Issues- Technical issues, Privacy vs Security, Data, Type of data, Protection of data, Security – challenges and requirements, E-commerce players and attacks, Defenses: Firewall, Network security, , Emerging firewall management issues, Types of online transactions, Requirement for online transactions, Securing the Network Transactions – Cryptography - Encryption, Public key encryption vs Private key encryption, Security Protocols for Web Commerce – SSL, SET, SHTTP.

Unit-3 Electronic Payment system.

Overview of E- payment system, Pre, Post and Instant payment methods in e-commerce, Digital cash, Properties, Electronic cheques and benefits, online credit card system, types of credit card payments, secure electronic transactions, Debit cards, E-benefit transfer.

Unit-4 E business Issues and Internet Marketing

E-Business, Organizational issues, Implementation issues, Marketing issues, Model for E business, Internet Marketing, Different stages of internet marketing, Critical success factor of internet marketing, E commerce strategies for development, E-commerce & sales.

Unit -5 Cyber laws

Definition, Need for cyber laws, Jurisprudence of Indian cyber law, Cyber crimes and criminal justice IT ACT2000 objectives, E-governance, digital signature, Sections related to ,Electronic records, Attribution, acknowledgement and dispatch of Electronic Records, security of E-records and digital signature, Controller functions, Certificates, subscriber duties, Penalties and Adjudications, Cyber regulation Appellate tribunal, Offences, Contracts in the InfoTech world, Power of arrest without warrant a critique, IT Act Modifications. Cyber consumer protection.

Reference Books:

- E Commerce, Bharat Bhasker TMH
- E- Commerce, Ravi kalakote, Pearson ed.
- E commerce , Lauden , PHI
- Cyber Law Simplified , VivekSood, TMH

Digital Forensic

CSE 4017 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
CO2	Underline the need of digital forensic and role of digital evidences
CO3	Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.
CO4	Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Unix system.
CO5	List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools.

Prerequisite: Cryptography and Security

Course Contents:

UNIT 1: Introduction to Cyber Crime and Ethical Hacking

Introduction of Cybercrime: Types of cybercrime ,categories of cybercrime , Computers' roles in crimes, Prevention from Cyber crime, Hackers, Crackers, Phreakers
Ethical Hacking: Difference between Hacking and Ethical hacking : Steps of Ethical Hacking, Exploring some tools for ethical hacking

UNIT 2: Introduction to Digital Forensics and Digital Evidences

Digital Forensic, Rules for Digital Forensic The Need for Digital Forensics, Types of Digital Forensics, Ethics in Digital Forensics, Digital Evidences : Types and characteristics and challenges for Evidence Handling

UNIT 3: Incidence Response Process and Live Data Collection

Introduction, Goals of Incident response, Incident Response Methodology, Formulating Response Strategy IR Process – Initial Response, Activities in Initial Response, Phases after Detection of an Incident Live Data Collection : Live Data collection from UNIX System: Live Data

UNIT 4: Forensic Duplication and Disk Analysis, and Investigation

Forensic Duplication : Forensic Image Formats, Traditional Duplication, Live System Duplication
Disk and File System Analysis: Media Analysis Concepts, Partitioning and Disk Layouts, Special Containers, Hashing, Carving, Forensic Imaging
Data Analysis: Analysis Methodology Investigating UNIX systems , Investigating Applications, Web Browsers, Email, Malware Handling: Static and Dynamic Analysis

UNIT 5: Report and Forensic Tools: Report

Goals of Report, Layout of an Investigative Report, Guidelines for Writing a Report, sample for writing a forensic report.
Computer Forensic Tools: need and types of computer forensic tools, task performed by computer forensic tools . Study of open source Tools like SFIT, Autopsy etc. to acquire, search, analyze and store digital evidence

Reference Books:

- Jason Luttgens, Matthew Pepe, Kevin Mandia, "Incident Response and computer forensics",3rd Edition Tata McGraw Hill, 2014.
- Nilakshi Jain, DhananjayKalbande, "Digital Forensic" Wiley India Pvt Ltd 2017 ISBN: 9788126578399, 320 pages.
- Cory Altheide, Harlan Carvey "Digital forensics with open source tools "Syngress Publishing, Inc. 2011.
- Chris McNab, Network Security Assessment, By O'Reily.

Robotics & Vision Control

CSE 4044 **3 – 0 – 0 = 3**

Course Outcomes

CO1	To learn about kinematics and dynamics
CO2	To design controllers for tracking control of a robot
CO3	To apply computer vision for motion control of robotic systems

Course Contents:

Computer vision :Introduction. The human eye and the camera.Vision as an information processing task.Homogeneous transformations.A geometrical framework for vision.2D and 3D images interpretation.Industrial applications.
Digital Image. Basics of image processing.Image acquisition. Segmentation, Binary and grey morphology operations. Thresholding.Filtering.Edge and corner detection.Features detection.Contours.Tracking edges and corners. Object detection and tracking. Image data compression, Real time Image processing.
Lighting in Machine Vision.Introduction.Light used in machine vision. Basic rules and laws of light distribution.Filters. Light sources. Light techniques. Choice of illumination.
Camera and Optical System.Camera technology.Analog and digital camera.Camera model.CCD and CMOS Technology.Sensor size.Intrinsic and extrinsic camera parameters. Camera calibration.Systems of lenses The thin lens. Beam converging and beam diverging lenses. General imaging equation.Aberrations.Practical aspects.
Fundamental of Robot.Robotics.Introduction.Robot.Definition.Robot anatomy.Robot parts and their functions.Classification of robot and robotic systems.Laws of robotic.Co-ordinate systems. Drives and control systems, Power transmission systems. Planning for navigation.Different applications.
Robot actuator effectors.Types of end effectors.Types of grippers. Interface. Sensors.Touch and Tactile sensors.
Kinematics of Robot.Introduction.Definition. Open and closed kinematic mechanisms. Matrix representation.Homogeneous transformation, forward and inverse kinematics. Direct vs inverse kinematic task. Programming.Basics of Trajectory planning.
Industrial applications.Quality control.Mapping and robot guidance.Motion estimation.Passive navigation and structure from motion .Autonomous systems.

Reference Books:

- Computer Vision: Algorithms and Applications, Richard Szeliski, Ed. Springer, ISBN-10: 1848829345,ISBN-13: 978- 1848829343, Publishing, 2010.
- Handbook of Robotics, Bruno Siciliano, Ed. Springer-Verlag Berlin and Heidelberg GmbH & Co. K, ISBN-10: 354023957X, ISBN-13: 978-3540239574,Publishing, 2008.

Shri Mata Vaishno Devi University

Campus: Kakryal, Katra 182 320
Phone: 01991-285699, 285634 Fax: 01991-285694

Public Relations Office:
Kalika dham, Near railway Station, Jammu-180004
Telefax: 0191-2470067

Website: www.smvdu.ac.in

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