Rajasthan Technical University, Kota
Department of Computer Science& Engineering
Scheme for B.Tech. (Computer Science & Engineering) 2020-21
Theory and Practical
CBCSUG2020

SEMESTER-VI						
Paper Code	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
6CSDC16	CSL316	Compiler Design	3	3		
6CSDC17	CSL317	Computer Graphics	4	3		2
6CSDC18	CSL318	Computer Architecture and Organization	3	3		
6CSDC19	CSL319	Distributed System	3	3		
6CSDC20	CSP320	Emerging Technology Lab	2			4
CSN202	CSN202	Seminar-2				2
6CSDEXX	CSLXXX	Department Elective Group-3*	*			
6CSDEXX	CSLXXX	Department Elective Group-4*	*			
XXXXX	XXXXX	Open Elective #	#			
SAA100	SAA100	SODECA (Anandam)	0.5			
		Sub Total (excluding OC and DE)	**15.5**	**12**		**8**

*** Every student has to earn minimum 20 credits by clearing department elective courses over the complete duration of the B.Tech programme.**

 # Every student has to earn minimum 10 credits by clearing open elective courses over the complete duration of the B.Tech programme. The student may opt for open elective courses floated by other department before the commencement of semester.

Department Elective (Group-3)							
S. No	**Course Code**	**Course Title**	**Course Title**	**C**	**L**	**T**	**P**
1.	6CSDE29	CSL329	Digital Image Processing	4	3		2
2.	6CSDE30	CSL330	Nature Inspired Algorithms	4	3		2
3.	6CSDE31	CSL331	Software Testing and Quality Assurance	4	3		2
Department Elective (Group-4)							
S. No	**Course Code**	**Course Title**	**Course Title**	**C**	**L**	**T**	**P**
1.	6CSDE32	CSL332	Data Mining And Business Intelligence	3	3		
2.	6CSDE33	CSL333	Data Compression Techniques	3	3		
3.	6CSDE34	CSL334	Software Defined Network	3	3		

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SYLLABUS

Semester	**VI**
Branch	**CSE**
Admission Year	**2020-21**
Academic Year	**2022-23**

Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC16	CSL316	Compiler Design	3	3		
Pre-requisites/Exposure			1 Programming for Problem solving – CSL 101				

Course Objectives:

To provide a thorough understanding of the internals of Compiler Design and to extend the knowledge of parser by parsing LL parser and LR parser.To apply the code generation algorithms to get the machine code for the optimized code and Understand design/implementation issues involved with storage allocation and binding, control flow, parameter passing, symbol table. To understand the machine dependent code and to apply the optimization techniques to have a better code for code generation.

UNIT - I:

Compiler, Translator, Interpreter definition, Phase of compiler, Bootstrapping, Review of Finite automata lexical analyzer, lexems, Input, Recognition of tokens, Idea about LEX: A lexical analyzer generator, Error handling.
.[T1,T2][No. of hrs. 5]

UNIT - II:

Review of CFG Ambiguity of grammars, Syntax Analysis, Introduction to parsing. Top down parsing, LL grammars & passers error handling of LL parser, Recursive descent parsing predictive parsers, Bottom up parsing, Shift reduce parsing, LR parsers, Construction of SLR, Conical LR & LALR parsing tables, parsing with ambiguous grammar. Operator precedence parsing, Introduction of automatic parser generator: YACC error handling in LR parsers.
[T1,T2][No. of hrs. 12]

UNIT - III:

Semantic Analysis, Syntax directed definitions; Construction of syntax trees, S-Attributed Definition, L-attributed definitions, Top down translation.
Type checking: type system, specification of simple type checker. Storage organization, Storage allocation, Strategies, Activation records, Accessing local and non-local names in a block structured language, Parameters passing, Symbol table organization, Data structures used in symbol tables.
[T1,T2][No. of hrs. 8]

UNIT - IV:

Intermediate code forms using postfix notation, DAG, Three address code, TAC for various control structures, Representing TAC using triples and quadruples, Boolean expression and control structures. Definition of basic block control flow graphs, DAG representation of basic block, Advantages of DAG.
[T1, T3][No. of hrs. 8]

UNIT - V:

Introduction to Code optimization: Sources of optimization, Loop optimization, Idea about global data flow analysis, Loop invariant computation, Peephole optimization, Issues in design of code generator, A simple code generator, Code generation from DAG. constant propagation, liveness analysis, common subexpression elimination.
[T1, T3][No. of hrs. 7]

Text Books:

1. Aho, Ullman and Sethi: Compilers, Addison Wesley
2. Holub, Compiler Design in C, PHI
3. Louden. Compiler Construction: Principles and Practice, Cengage Learning

Reference Books:

1. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	6CSDC16	CSL316	Compiler Design	3	3		
Pre-requisites/Exposure			1 Programming for Problem Solving-CSL 101				

List of Experiments :

1. To identify whether given string is keyword or not?
2. Count total no. of keywords in a file. [Taking file from user]
3. Count total no of operators in a file. [Taking file from user]
4. Count total occurrence of each character in a given file. [Taking file from user]
5. Write a C program to insert, delete and display the entries in Symbol Table.
6. Write a LEX program to identify:
    1. Valid mobile number
    2. Valid url
    3. Valid identifier
    4. Valid date (dd/mm/yyyy)
    5. Valid time (hh:mm:ss)
7. Write a lex program to count blank spaces,words,lines in a given file.
8. Write a lex program to count the no. of vowels and consonants in a C file.
9. Write a YACC program to recognize strings aaab,abbb using a^nb^n, where b>=0.
10. Write a YACC program to evaluate an arithmetic expression involving operators +,-,* and /.
11. Write a YACC program to check validity of a strings abcd, aabbcd using grammar a^nb^nc^md^m, where n , m>0
12. Write a C program to find first of any grammar.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL316	Compiler Design	CO 1	Explain the knowledge of System Software such as Translators, Assemblers, and understand different phases of compilers.(K3)
		CO 2	To be able to evaluate and implement lexical, semantic rules and grammars for a programming language.(K4)
		CO 3	To determine the principles, algorithms, and data structures involved in the design and construction of compilers and parsers by using theory of computation.(K4)
		CO 4	To be able to understand the requirement of heap and stack memory allocation system in programming.(K2)
		CO 5	To be able to apply optimization while doing simple programming.(K4)

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CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
Compiler Design	CO 1	3		2	1	1							2
	CO 2	3	2	2	2	1							
	CO 3	2	3	2	2								
	CO 4	2	2										
	CO 5	3	2	3	2		1		1				

3. Strong **2. Moderate** **1. Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC17	CSL317	Computer Graphics	4	3		2
Pre-requisites/Exposure							

Course Objective:
The course introduces the basic concepts of computer graphics. It provides the necessary theoretical background and demonstrates the application of computer science to graphics.

UNIT – 1

Introduction and Line Generation: Types of computer graphics, Graphic Displays, Random scan displays, Raster scan displays, Frame buffer and video controller, Scan Conversion of Point, Line, Circle, Ellipse and Polygon, Introduction to Aliasing and Anti Aliasing technique. **[T1,T2][No. of hrs. 10]**

UNIT – II
Transformations: Basic transformation, Matrix representations and homogeneous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Point Clipping; 2-D Line clipping: Cohen Sutherland, Liang Barsky and Cyrus–Beck line clipping algorithm; 2-D Polygon clipping: Sutherland Hodgeman, Weiler and Atherton polygon clipping **[T1,T2][No. of hrs. 10]**

UNIT – III:
3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections. **[T1,T2][No. of hrs. 8]**

UNIT – IV:
Hidden Lines & Surfaces: Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, Curves and Splines: Parametric and Non parametric Representations, Bezier curve, Spline Curves. **[T1,T2] [No. of hrs. 6]**

UNIT – V:
Rendering: Basic illumination model, Diffuse reflection, Specular reflection, Phong shading, Gourand shading, Ray tracing, Color models like RGB, YIQ, CMY, HSV. **[T1,T2] [No. of hrs. 6]**

Text Books:

[T1] "Human- D. Hearn and M. Pauline Baker, Computer Graphics (C Version), Pearson Education, 2nd Edition, 2004.

[T2] Foley, A. Van Dam, S. Feiner, J. Hughes: Computer Graphics- Principles and Practice, Pearson

Reference Books:
[R1] D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2ndEdition, McGraw-Hill International Edition, 1990

[R2] Curves and Surfaces for Computer Aided Geometric Design by G Farin, Academic Press

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	6CSDC17	CSL317	Computer Graphics	4	3		2
Pre-requisites/Exposure							

List of Experiments:-

1. WAP to draw Line, Circle, ellipse, other curves and also fill the colours using inbuilt function. Using inbuilt function draw the given fig. 1

fig. 1

2. WAP to implement Digital Differential Analyzer Algorithm(DDA) and Bresenham's Line Drawing Algorithm. Using These algorithms draw a bar graph . Input to the program is to include the data points and the labelling required for the x and y axes. The data points are to be scaled by the program so that the graph is displayed across the full screen area.

3. WAP to implement Midpoint Circle Generation Algorithm. Using this algorithm display a pie chart with appropriate labeling. Input to the routine is to include a data set giving the distribution of the data over some set of intervals, the name of the pie chart, and the names of the intervals. Each section label is to be displayed outside the boundary of the pie chart near the corresponding pie section.

4. WAP to implement the midpoint ellipse algorithm assuming the start position is (rx, 0) and points are to be generated along the curve path in counter clockwise order.

5. Perform 2D geometric transformations- Translation, Rotation, Scaling, Reflection, shearing on fig-1 which is implemented in Experiment 1.

6. Draw a polygon using any line drawing algorithm and perform line clipping using Cyrus-Beck, Cohen-Sutherland and Liang-Barsky algorithms against a selected window.

7. Write a program to implement Boundary Fill algorithm and Flood Fill algorithm. Using these fill the colour in fig-1 which is implemented in Experiment 1.

In this experiment you should work on your old interface (fig-1) to add more features, you should create a menu and a submenu, the main menu should have the following Entries (Background color, add teams, add a Ball), each submenu have the following entries:

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1. Background colour: Red, White, Brown, Grey.
2. Add Teams: Team 1 (Left): this choice will add 11 players on the left field and you can select any shapes to represent the player for example you can use a circle but don't forget to color the players in the same team with the same colour. Team 2 (right): this choice will add 11 players on the Right field and you can select any shapes to represent the player for example you can use a circle but don't forget to color the players in the same team with the same color " .
3. Add a ball: Centre, left Penalty point, right Penalty point, corners (the corners should be numbered 1,2,3,4 and give the user a choice to select any one of them).

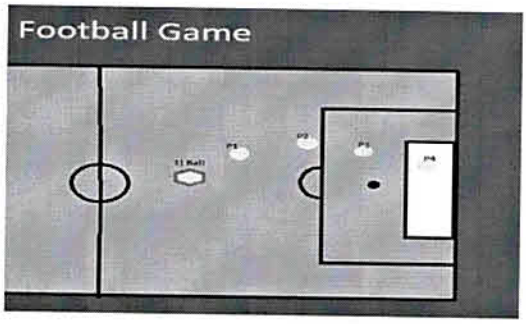
Your new interface should be more advanced by adding audience and Strips.

8. .Perform 3D geometric transformations- Translation, Rotation, Scaling, Reflection, shearing on fig-1 which is implemented in Experiment 1.

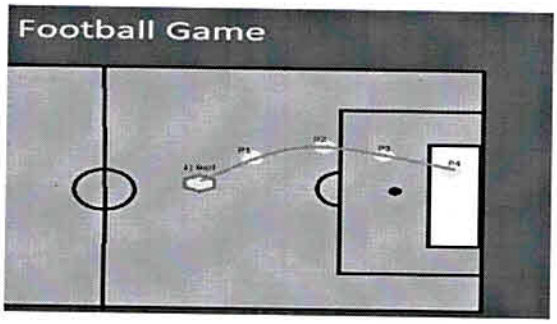
9. In this experiment you should work on your old interface to add the following features:

1. Using mouse Function you should let the user to choose where to put the ball (once the user clicks the mouse anywhere inside the playground you should draw a ball there).
2. Let the user draw the Kick curve then the ball should go through this curve (Note here you should define the starting and end points).

   To Draw the kicking curve you will wait until the user specify the path of the curve using mouse click (note here that you will wait for 4 points i.e 4 clicks from the user), see the following figure.



- The first click to specify where to draw the Ball.
- Clicks from 2 to 5 to specify the path of the curve (P1, P2, P3 and P4).
- Once completed, your program should draw the kicking curves passes through the specified points (Ball ,P1,P2,P3 and P4) as the following figure :



- Now your curve is ready and your program should have a menu with the following items:

1. Kick the ball (fast mode): your ball moves on the kicking curve quickly.
2. Kick the ball (Medium speed mode): your ball moves on the kicking with Medium speed.
3. Kick the ball (slow mode): your ball moves on the kicking with low speed.

Hint : use the Timer Function to control the move speed .

Your interface should be implemented in 3D environment.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL317	COMPUTER GRAPHICS	CO 1	Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
		CO 2	Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
		CO 3	Use of geometric transformations, viewing and clipping algorithms for 2D and 3D graphics objects.
		CO 4	Determine projections and visible surface detection techniques for display of 3D scene on 2D screen.
		CO 5	Render projected objects to naturalize the scene in 2D view and use of illumination models for this.

CO-PO MAPPING:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
Computer Graphics	CO1	2	3	2									1
	CO2	3	3	2	2								
	CO3	3	3	2	2								
	CO4	3	2	2	2								
	CO5	3	3	3	3	1	2			2	2		2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC18	CSL318	Computer Architecture and Organization	3	3		
Pre-requisites/Exposure							

Course Objective:
To understand the structure, function and characteristics of computer systems. To understand the design of the various functional units and components of computers. To identify the elements of modern instructions sets and their impact on processor design.

UNIT – 1:
Introduction: Objective, scope and outcome of the course. Computer Data Representation: Basic computer data types, Complements, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Register Transfer language, Register Transfer, Bus and Memory Transfers (Tree-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logical shift unit.. **[T1,T2][No. of hrs. 06]**

UNIT – II:
Basic Computer Organization and Design Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer, design of Accumulator Unit Micro programmed Control: Control Memory, Address sequencing, Micro program Example, Design of control Unit.. **[T1,T2][No. of hrs. 06]**

UNIT – III:
Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), Pipeline And Vector Processing, Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors. **[T1,T2][No. of hrs. 07]**

UNIT – IV:
Computer Arithmetic: Introduction, Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, Decimal Arithmetic Unit. Input-Output Organization, Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor (IOP), CPUIOP Communication, Serial communication. **[T1,T2] [No. of hrs. 07]**

UNIT – V
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. Multi-pre-processors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter- processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors. **[T1,T2][No. of hrs. 05]**

Text Books:
[T1] Title : Computer System Architecture, Author: M. Morris Mano, Publisher: Prentice Hall of India Pvt Ltd
[T2]. Title: Computer Architecture and Organization, Author:J .P. Hayes, Publisher:McGraw-Hill

Reference Books:
[R1] Title: Computer Organization and Design - The Hardware/Software Interface, Author: D. A. Patterson and J. L. Hennessy, Publisher: Morgan Kaufmann
[R2].Title:Computer Organization and Architecture - Designing for Performance, Author:W. Stallings, Publisher: Prentice Hall of India

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[R3] Title: Computer Organization, Author: C. Hamacher, Z. Vranesic and S. Zaky, Publisher: McGrawHill

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL318	Computer Architecture and Organization	CO 1	Describe classification of Computer Architecture and Micro Operations
		CO 2	Categorize memory organization and explain the function of each element of a memory hierarchy
		CO 3	To Use addressing modes, instruction format and pipelining structure
		CO 4	Demonstrate computer Arithmetic. Identify and compare different methods for computer I/O mechanisms

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	O 12
Computer Architecture and Organization	CO1	2	2	2	1	2							
	CO2	3	2	3	2	1							
	CO3	3	1	2		1							
	CO4	3	3	3	1	2							

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC19	CSL319	Distributed System	3	3		
Pre-requisites/Exposure			Operating Systems-CSL313				

Course Objectives:

This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

UNIT-I

Distributed Systems: Features of distributed systems, nodes of a distributed system, Distributed computation paradigms, Model of distributed systems, Types of Operating systems: Operating System, Network Operating Systems, Distributed Operating Systems, and Cooperative Autonomous Systems, design issues in distributed operating systems. Systems Concepts and Architectures: Goals, Transparency, Services, Architecture Models, Distributed Computing Environment (DCE). **[T1] [No. of hrs. 7]**

UNIT-II

Theoretical issues in distributed systems: Notions of time and state, states and events in a distributed system, time, clocks and event precedence, recording the state of distributed systems. Concurrent Processes and Programming: Processes and Threads, Graph Models for Process Representation, Client/Server Model, Time Services, Language Mechanisms for Synchronization. Inter-process Communication and Coordination: Message Passing, Request/Reply and Transaction Communication, Name and Directory services, RPC and RMI case studies. **[T1,T2] [No. of hrs. 7]**

UNIT-II

Distributed Process Scheduling: A System Performance Model, Static Process Scheduling with Communication, Dynamic Load Sharing and Balancing, Distributed Process Implementation. Distributed File Systems: Transparencies and Characteristics of DFS, DFS Design and implementation, Data and File Replication.
Case studies: Sun network file systems, General Parallel File System and Window's file systems. Andrew and Coda File Systems. **[T1] [No. of hrs. 6]**

UNIT-IV

Distributed Shared Memory: Non-Uniform Memory Access Architectures, Memory Consistency Models, Multiprocessor Cache Systems, Distributed Shared Memory, Implementation of DSM systems. Models of Distributed Computation: Preliminaries, Causality, Distributed Snapshots, Modelling. Distributed Computation, Failures in a Distributed System. **[T1, T2] [No. of hrs. 6]**

UNIT-V

Distributed Agreement: Concept of Faults, failure, and recovery, Byzantine Faults, Adversaries, Byzantine Agreement, Impossibility of Consensus and Randomized Distributed Agreement. CORBA case study: Introduction, Architecture, CORBA RMI, CORBA Services. **[T2] [No. of hrs. 6]**

Text Books:

[T1] Distributed operating systems and algorithm analysis by Randy Chow and T. Johnson, Pearson
[T2] Operating Systems A concept-based approach by DM Dhamdhere, TMH

Reference Books:

[R1] Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
[R2] Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating sys. McGraw-Hill, Inc., 1994.
[R3] Tanenbaum A.S., Van Steen M., —Distributed Systems: Principles and Paradigmsl, Pearson Education, 2007.
[R4] Liu M.L., Distributed Computing, Principles and Applicationsl, Pearson Education, 2004.
[R5] Nancy A Lynch, —Distributed Algorithmsl, Morgan Kaufman Publishers, USA, 2003.

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Course Outcome:

Course Code	Course Name	Course Outcome	Details
CSL319	Distributed System	CO1	Understand basic concept, principles and techniques behind distributed system model.
		CO2	Describe software components of distributed computing systems, communication and interconnection architecture of computer systems.
		CO3	Differentiate design issues related to a centralized system and a distributed system.
		CO4	Summarize security issues and development of fault tolerant distributed system.
		CO5	Analyze different distributed file systems(Case Study).

CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Distributed System	CO1		2	2			2	1	1				
	CO2	3	2	3	3		2		1	2		2	2
	CO3	1	2	2	2		2	2	2	2			3
	CO4	3	3	3	2	2	2	3	2			2	
	CO5	3	3	3	2	1		2	2			2	1

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC20	CSP320	Emerging Technology Lab	2			4

Note: As per availability of the industrial expert.

Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE29	CSL329	Digital Image Processing	4	3		2
Pre-requisites/Exposure							

Course Objectives:

To introduce the concepts of image processing and basic analytical methods to be used in image processing. To familiarize students with image enhancement and restoration techniques, To explain different image compression techniques. To introduce segmentation and morphological processing techniques.

UNIT- I :

Introduction and Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbors, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations. Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
[T1, T2][No. of Hrs: 10]

UNIT- II:

Filtering in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters. Image Restoration: A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.
[T1, T2][No. of Hrs. 12]

UNIT- III:

Image Compression: fundamentals of compression, coding redundancy, Lossy and lossless compression, Spatial and temporal redundancy, Image compression models. Some basic compression methods. Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Region Oriented Segmentation, Motion based segmentation.
[T1, T2][No. of Hrs. 12]

UNIT- IV:

Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms. Object Recognition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.
[T1, T2][No. of Hrs: 10]

Text Books:

[T1] Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 3Rd edition, Pearson, 2002.
[T2] A.K. Jain, "Fundamental of Digital Image Processing", PHI, 1989.

Reference Books:

[R1] Bernd Jahne, "Digital Image Processing", 5th Ed., Springer, 2002.
[R2] William K Pratt, "Digital Image Processing: Piks Inside", John Wiley & Sons, 2001.

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Elective)	C	L	T	P
CSE2020	6CSDE29	CSL329	Digital Image Processing	4	3		2
Pre-requisites/Exposure							

List of Experiments:

Software Experiments:

1. Generation of basic signals sine, cosine, ramp, step, impulse and exponential in continuous and discrete domains using user defined functions.
2. Write a program to find convolution (linear/circular) and correlation of two discrete signals.
3. Perform linear convolution using circular convolution and vice versa.
4. Write a program to
   i. Find 8 point DFT, its magnitude and phase plot and inverse DFT.
   ii. Find 16 point DFT, its magnitude and phase plot and inverse DFT.
5. Perform the following properties of DFT.
   i. Circular shift of a sequence.
   ii. Circular fold of a sequence.
6. Write a program to design FIR Low pass filter using
   i. Rectangular window
   ii. Hanning window
   iii. Hamming window
   iv. Bartlett window
7. Write a program to
   i. Implement a Low pass / High pass / Band pass / Band stop IIR Filter using Butterworth Approximation.
   ii. Implement a Low pass / High pass / Band pass / Band stop IIR Filter using Chebyshev Approximation.

Hardware Experiments using Texas Instruments Kits-DSK 6713:

8. Introduction to Code composer Studio.
9. Write a program to generate a sine wave and see the output on CRO
10. Write a Program to Generate ECHO to give audio file.
11. Write a program to demonstrate Band Stop filter by FIR.

Additional Experiments:

12. Write a program to generate a cos wave and see the output on CRO
13. Write a program to blink the LED
14. Write a program to display a string on LCD.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

Course Outcome:

Course Code	Course Name	Course Outcome	Details
CSL329	Digital Image Processing	CO 1	Compare different methods for image acquisition, storage and representation in digital devices and computers
		CO 2	A role of image transforms in representing, highlighting, and modifying image features
		CO 3	Interpret the mathematical principles in digital image enhancement and apply them in spatial domain and frequency domain
		CO 4	Apply various methods for segmenting image and identifying image components
		CO 5	Summarize different reshaping operations on the image and their practical applications
		CO 6	Identify image representation techniques that enable encoding and decoding images.

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CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Digital Image Processing	CO 1	2											
	CO 2	2			2								
	CO 3				2								
	CO 4	2											
	CO 5	3											
	CO 6	2		3									

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE30	CSL330	Nature Inspired Algorithms	4	3		2
Pre-requisites/Exposure							

Course Objectives: To understand the various concepts of nature inspired algorithms. Detailed understanding of the Evolutionary Algorithms. Knowledge enhancement on the swarm intelligence based algorithms. Practical knowledge of the Discrete Nature Inspired Algorithms and Local Search Techniques. Implementation and Applications of the NIA for engineering optimization problem.

Syllabus:

Introduction to Nature Inspired Algorithms:

Overview of Computational Intelligence, Biologically inspired computing: nature as source of inspiration for the design of algorithms; Overview of the Nature Inspired Algorithms, Evolutionary Computation, Swarm Intelligence based algorithms.

Evolutionary Computation Theory and Paradigms:

History, overview, Genetic Algorithm, Differential Algorithm, Evolutionary Programming, Evolutionary Strategies. An overview of Evolutionary Algorithms, etc.

Swarm Intelligence Based Algorithms

Basic Particle Swarm Optimization, Global Best PSO, Local Best PSO, gbest versus, lbest PSO, Basic PSO Parameters, Artificial Bee Colony Algorithms, ANT Colony Optimization, Spider Monkey Optimization Algorithm, Gravitational Search Algorithm, Bio-Geography Based Optimization etc.

Discrete Nature Inspired Algorithms and Local Search Techniques: Discrete versions of the PSO, ABC, BBO, SMO Local Search Algorithms, Performance Evaluation of memetic algorithms, Parameterization and Balancing Local and Global Search, Memetic Algorithms in Discrete Optimization, Memetic Algorithms in Constrained Optimization, Multiobjective: Memetic Algorithms.

Step by step procedure of the Nature Inspired Algorithms, Applications and implementation of Nature Inspired Algorithms to solve engineering optimization problems for example Knapsack Problem, Quadratic Assignment Problem, Robot Path Planning Problem, Job Shop Scheduling Problem etc.

TEXT BOOKS:

1. Engelbrecht, Andries P. Computational intelligence: an introduction. John Wiley & Sons, 2007.
2. Smolinski, Tomasz G., Mariofanna G. Milanova, and Aboul-Ella Hassanien, eds. *Applications of computational intelligence in biology: current trends and open problems*. Vol. 122. Springer, 2008.
3. Clerc, Maurice. *Particle swarm optimization*. Vol. 93. John Wiley & Sons, 2010.
4. Hariri, S., and M. Parashar. "Handbook of bioinspired algorithms and applications, chapter the foundations.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL330	NATURE INSPIRED ALGORITHMS	CO1	Define the basic concept of natural phenomenon for developing the optimization algorithms
		CO2	Classify the evolutionary algorithms as per the optimization problem
		CO3	Apply the swarm intelligence based algorithms to solve the engineering optimization problems
		CO4	Analyze the discrete variants of the nature inspired algorithms
		CO5	Develop the step by step learning mechanism of the nature inspired algorithms

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE31	CSL331	Software Testing and Quality Assurance	4	3		2
Pre-requisites/Exposure							

Course Objectives:

To understand test management strategies and tools for testing. Learn to apply the testing strategies and methodologies in projects. To learn in detail about various quality assurance models.

UNIT – 1:

Faults, Errors, and Failures, Basics of software testing, Testing objectives, Principles of testing, Requirements, behavior and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking. **[T1,T2,T3][No. of hrs. 6]**

UNIT – II:

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.**[T1,T2,T3][No. of hrs. 6]**

UNIT – III:

Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality. **[T1,T2,T3][No. of hrs. 7]**

UNIT – IV:

SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools. **[T1,T2,T3] [No. of hrs. 6]**

UNIT – V:

Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM. Software Process- PSP and TSP, OO Methodology, Clean-room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their Effect on Software Quality **[T1,T2,T3] [No. of hrs. 6]**

Text Books:

[T1] Srinivasan Desikan, Gopalaswamy Ramesh,Software Testing: Principles and Practices Pearson.
[T2] Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley.
[T3] Aditya P. Mathur, Foundations of Software Testing, Pearson

Reference Books:

[R1] Gordon G Schulmeyer, "Handbook of Software Quality Assurance", Third Edition, Artech House Publishers 2007
[R2] Nina S Godbole, "Software Quality Assurance: Principles and Practice", Alpha Science International, Ltd, 2004

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL331	Software Test and Quality Assurance	CO1	Knowledge of quantitative, technical, practical methods that software engineers and developers can use to test their software
		CO2	Test the software by applying testing techniques to deliver a product free from bugs.
		CO3	Understand test management strategies and tools for testing.
		CO4	To explain quality assurance and various tools used in quality management.
		CO5	Apply quality tools and techniques in their projects.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Software Test and Quality Assurance	CO1	3	3	2	3	3				1	1		2
	CO2	3	3	2	3	3		2	2	1	2	2	3
	CO3	3	3	2	2	3		2		1	2	1	1
	CO4	3	3	2	2	3				1	1	2	1
	CO5	3	3	2	2	3			2	1	1	2	2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDE32	CSL332	Data Mining And Business Intelligence	3	3		
Pre-requisites/Exposure			Data Analysis & AI Using Python -CSL101				

Course Objectives:

This course is designed to introduce students to business intelligence concepts and provide students with an understanding of data warehousing and data mining along with associated techniques and their benefits to organizations of all sizes.

UNIT-I:

Introduction: Evolution and importance of Data Mining-Types of Data and Patterns mined Technologies-Applications-Major issues in Data Mining. . **[T1][No. of hrs. 5]**

UNIT-II:

Knowing about Data- Data Preprocessing: Cleaning– Integration–Reduction–Data transformation and Discretization. **[T1][No. of hrs. 6]**

UNIT-III:

Data Warehousing: Basic Concepts-Data Warehouse Modeling- OLAP and OLTP systems - Data Cube and OLAP operations–Data Warehouse Design and Usage-Business Analysis Framework for Data Warehouse Design- OLAP to Multidimensional Data Mining. **[T1][No. of hrs. 8]**

UNIT-IV:

Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods – Mining Association Rules – Association to Correlation Analysis. Classification and Predication: Issues - Decision Tree Induction - Bayesian Classification – Rule Based Classification – k-Nearest mining Classification. Prediction –Accuracy and Error measures. Clustering: Overview of Clustering – Types of Data in Cluster Analysis – Major Clustering Methods. **[T1][No. of hrs. 12]**

UNIT-V:

Introduction to BI -BI definitions and concepts- BI Frame work-Basics of Data integration Introduction to Business Metrics and KPI - Concept of dash board and balance score card. Tool for BI: Microsoft SQL server: Introduction to Data Analysis using SSAS tools Introduction to data Analysis using SSIS tools- Introduction to Reporting Services using SSRS tools- Data Mining Implementation Methods. **[T2][No. of hrs. 9]**

Text Books:

[T1] Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Elsevier Publisher, 2006.

[T2] Loshin D, "Business Intelligence", First Edition, Elsevier Science, 2003.

Reference Books:

[R1] K.P.Soman, Shyam Diwakar and V.Ajay, "Insight into Data Mining Theory and Practice", PHI of India, 2006.

[R2] Darren Herbold, Siva Kumar Harinath, Matt Carroll, Sethu Meenakshisundaram, Robert Zare and Denny Guang-Yeu Lee, "Professional Microsoft SQL Server Analysis Services 2008 with MDX", Wrox, 2008.

[R3] T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", PHI/Pearson.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL332	Data Mining and Business Intelligence	CO1	Understand the functionality of the various data mining components.
		CO2	Appreciate the strengths and limitations of various data mining models.
		CO3	Compare and contrast the various clustering methods and classifiers.
		C04	Examine CRM concepts and solutions.
		CO5	Describe and utilize a range of techniques for designing data warehousing and data mining systems for real-world applications.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Data Mining And Business Intelligence	CO1	1	2	2			2	2	2				
	CO2	3	3	2	2		1		1			1	
	CO3		2	3	3		2	2	2				
	C04	3	3	3	2	2	2	1	1			3	
	CO5	3	3	3	2	2		2	2			3	3

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE33	CSL333	Data Compression Techniques	3	3		
Pre-requisites/Exposure							

Course Objectives:
The objective of the course is to familiarize students with basic Data compression techniques.

UNIT 1
Compression Techniques: Lossless, lossy, measure of performance, modelling & coding.

Lossless compression: Derivation of average information, data models, uniquely decodable codes with tests, prefix codes, Kraft-Mc Millan inequality.
Huffman coding: Algorithms, minimum variance Huffman codes, optimality, length extended codes, adaptive coding, Rice codes, using Huffman codes for lossless image compression. **[T1,T2][No. of hrs. 8]**

UNIT 2
Arithmetic coding with application to lossless compression.

Dictionary Techniques: LZ77, LZ78, LZW.

Predictive coding: Burrows-Wheeler Transform and move-to-front coding, JPEG-LS.

Facsimile Encoding: Run length, T.4 and T.6 **[T1,T2][No. of hrs. 8]**

UNIT 3
Lossy coding- Mathematical preliminaries: Distortion criteria, conditional entropy, average mutual information, differential entropy, rate distortion theory, probability and linear system models.

Scalar quantization: The quantization problem, uniform quantizer, Forward adaptive quantization, non uniform quantization, formal adopting quantization, companded quantization

Vector quantization: Introduction, advantages, The Linde-Ruzo-Grey algorithm, lattice vector quantization.
[T1,T2][No. of hrs. 8]
UNIT 4

Differential encoding – Introduction, Basic algorithm, Adaptive DPCM, Delta modulation, speech and image coding using delta modulation.

Sampling in frequency and time domain, z-transform, DCT, DST, DWHT, quantization and coding of transform coefficient. **[T1,T2][No. of hrs. 8]**

UNIT 5

Sub band coding: Introduction, Filters, Basic algorithm, Design of Filter banks, G.722, MPEG.

Wavelet based compression: Introduction, wavelets multi-resolution analysis and the scaling function implementation using filters. **[T1,T2][No. of hrs. 8]**

.Text Books:

[T1] Sayood, K, Data Compression, Morgan Kauffman, 2006.

Yash Ranjan. 30/09/24

[T2] Saloman, Handbook of Data Compression

Reference Books:

[R1] Drew & Li, Fundamentals of Multimedia, PHI, 2006
[R2] Halsall, Multimedia Communications, Pearson Edu Asia, 2004
[R3] Parekh Ranjan, Principles of Multimedia, TMH, 2006

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL333	Data Compression Techniques	CO1	Explain the evolution and fundamental concepts of Data Compression and Coding techniques.
		CO2	Apply various coding techniques for compression of any raw data.
		CO3	Differentiate between Lossy and Lossless compression.
		C04	Understand the scalar quantization and vector quantization
		CO5	Determine Differential, Sub band Coding and Wavelet based Compression.

CO-PO MAPPING:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Data Compression Techniques	CO1	2	2	2	1								
	CO2	3	2		2								
	CO3	2	3		2								
	CO4	3	2	2	2								
	CO5	3	3	2	2								

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE34	CSL334	Software Defined Network	3	3		
Pre-requisites/Exposure							

Course Objectives:

To learn the fundamentals of software defined networks. To understand the separation of the data plane and the control plane. To study about the SDN Programming. To study about the various applications of SDN.

UNIT – I

SDN Origins and Evolution, Centralized and Distributed Control and Data Planes, SDN APIs, Virtualization of Network Functions (VNF) and NFV, Open Virtual Networking (OVN), Open Network Operating Systems (ONOS). **[T1,T2][No. of hrs. 9]**

UNIT – II

SDN ABSTRACTIONS- How SDN Works, The Open flow Protocol, Big picture and other protocols, Controller Platforms, SDN Software Stack(s). **[T1,T2][No. of hrs. 8]**

UNIT – III

PROGRAMMING SDN- Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs, Mininet Environment and Implementation. **[T1,T2][No. of hrs. 8]**

UNIT – VI

SDN APPLICATIONS IN SECURITY- Switching and Load Balancers, Firewall and Access Control, Use cases in Legacy Networks security. **[T1,T2][No. of hrs. 7]**

UNIT – V

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE. **[T1,T2][No. of hrs. 8]**

Text Books:

[T1] SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media
[T2] Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press

Reference Books:

[R1]Software Defined Networking with OpenFlow By Siamak Azodolmolky, Packt Publishing
[R2]Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" - William Stallings

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL334	Software Defined Network	CO1	Differentiate between traditional networks and software defined networks
		CO2	Understand advanced and emerging networking technologies
		CO3	Explain the use of SDN in the current networking scenario
		CO4	Learn how to use software programs to perform varying and complex networking tasks
		CO5	Expand upon the knowledge learned and apply it to solve real world problems

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
SOFTWARE DEFINED NETWORK	CO1	3		3	1								
	CO2	2				3					3		
	CO3	3		1		3	2		2			2	
	CO4	2	2	3				2			2		
	CO5	3	2	3	2						2		2

3: Strongly **2: Moderate** **1: Weak**

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