RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

COURSE HAND-OUT

B.TECH. - SEMESTER VII

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

RAJAGIRI SCHOOL OF ENGINEERING AND TECHNOLOGY (RSET)

VISION

TO EVOLVE INTO A PREMIER TECHNOLOGICAL AND RESEARCH INSTITUTION, MOULDING EMINENT PROFESSIONALS WITH CREATIVE MINDS, INNOVATIVE IDEAS AND SOUND PRACTICAL SKILL, AND TO SHAPE A FUTURE WHERE TECHNOLOGY WORKS FOR THE ENRICHMENT OF MANKIND

MISSION

TO IMPART STATE-OF-THE-ART KNOWLEDGE TO INDIVIDUALS IN VARIOUS TECHNOLOGICAL DISCIPLINES AND TO INCULCATE IN THEM A HIGH DEGREE OF SOCIAL CONSCIOUSNESS AND HUMAN VALUES, THEREBY ENABLING THEM TO FACE THE CHALLENGES OF LIFE WITH COURAGE AND CONVICTION

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CSE), RSET

VISION

TO BECOME A CENTRE OF EXCELLENCE IN COMPUTER SCIENCE & ENGINEERING, MOULDING PROFESSIONALS CATERING TO THE RESEARCH AND PROFESSIONAL NEEDS OF NATIONAL AND INTERNATIONAL ORGANIZATIONS.

MISSION

TO INSPIRE AND NURTURE STUDENTS, WITH UP-TO-DATE KNOWLEDGE IN COMPUTER SCIENCE & ENGINEERING, ETHICS, TEAM SPIRIT, LEADERSHIP ABILITIES, INNOVATION AND CREATIVITY TO COME OUT WITH SOLUTIONS MEETING THE SOCIETAL NEEDS.

B.TECH PROGRAMME

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates shall have up-to-date knowledge in Computer Science & Engineering along with interdisciplinary and broad knowledge on mathematics, science, management and allied engineering to become computer professionals, scientists and researchers.
2. Graduates shall excel in analysing, designing and solving engineering problems and have life-long learning skills, to develop computer applications and systems, resulting in the betterment of the society.
3. Graduates shall nurture team spirit, ethics, social values, skills on communication and leadership, enabling them to become leaders, entrepreneurs and social reformers.

PROGRAMME OUTCOMES (POs)

Graduates will be able to achieve

a. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems.

b. An ability to identify, analyse, formulate and solve technical problems by applying principles of computing and mathematics relevant to the problem.

c. An ability to define the computing requirements for a technical problem and to design, implement and evaluate a computer-based system, process or program to meet desired needs.

d. An ability to learn current techniques, skills and modern engineering tools necessary for computing practice.

e. An ability to carry out experiments, analyse results and to make necessary conclusions.

f. An ability to take up multidisciplinary projects and to carry out it as per industry standards.

g. An ability to take up research problems and apply computer science principles to solve them leading to publications.

h. An ability to understand and apply engineering solutions in a global and social context.

i. An ability to understand and practice professional, ethical, legal, and social responsibilities as a matured citizen.

j. An ability to communicate effectively, both written and oral, with a range of audiences.

k. An ability to engage in life-long learning and to engage in continuing professional development.

l. An ability to cultivate team spirit and to develop leadership skills thereby moulding future entrepreneurs.

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SCHEME: B.TECH 7TH SEMESTER

(Computer Science & Engineering)

Kerala Technological University Revised Scheme for B.Tech Syllabus Revision 2015

Course Code	Course Name	L-T-P	Credits	Exam Slot
CS401	Computer Graphics	4-0-0	4	A
CS403	Programming Paradigms	3-0-0	3	B
CS405	Computer System Architecture	3-0-0	3	C
CS407	Distributed Computing	3-0-0	3	D
CS409	Cryptography and Network Security	3-0-0	3	E
	Elective	3-0-0	3	F
CS451	Seminar & Project Preliminary	0-1-4	2	S
CS431	Compiler Design Lab	0-0-3	1	T

Total Credits = 22 Hours: 27

Cumulative Credits= 162

CS401 Computer Graphics

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE & ENGINEERING**	DEGREE: **BTECH (October 2021 -February 2022)**
COURSE: **COMPUTER GRAPHICS**	SEMESTER: **VII** CREDITS: **4**
COURSE CODE: **CS401**	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: **RECENT TRENDS IN COMPUTING**	CONTACT HOURS: **4-0-0(L-T-P) hours/Week**.
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	LAB COURSE NAME: NIL

SYLLABUS:

UNIT	DETAILS	HOURS
I	Basic concepts in Computer Graphics – Types of Graphic Devices – Interactive Graphic inputs – Raster Scan and Random Scan Displays.	7
II	Line Drawing Algorithm- DDA, Bresenham's algorithm – Circle Generation Algorithms –Mid point circle algorithm, Bresenham's algorithm- Scan Conversion-frame buffers – solid area scan conversion – polygon filling algorithms	8
III	Two dimensional transformations. Homogeneous coordinate systems – matrix formulation and concatenation of transformations. Windowing concepts –Window to Viewport Transformation- Two dimensional clipping-Line clipping – Cohen Sutherland, Midpoint Subdivision algorithm	8
IV	Polygon clipping-Sutherland Hodgeman algorithm, Weiler-Atherton algorithm, Three dimensional object representation-Polygon surfaces, Quadric surfaces – Basic 3D transformations	8
V	Projections – Parallel and perspective projections – vanishing points. Visible surface detection methods– Back face removal- Z-Buffer algorithm, A-buffer algorithm, Depth-sorting method, Scan line algorithm.	9
VI	Image processing – Introduction - Fundamental steps in image processing – digital image representations – relationship between pixels – gray level histogram –spatial convolution and correlation – edge detection – Robert, Prewitt, Sobel.	8
	TOTAL HOURS	**48**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
	Text Books: 1. Donald Hearn and M. Pauline Baker, Computer Graphics, PHI, 2e, 1996 2. E. Gose, R. Johnsonbaugh and S. Jost., Pattern Recognition and Image Analysis, PHI PTR, 1996 (Module VI – Image Processing part) 3. William M. Newman and Robert F. Sproull , Principles of Interactive Computer Graphics. McGraw Hill, 2e, 1979 4. Zhigang Xiang and Roy Plastock, Computer Graphics (Schaum's outline Series), McGraw Hill, 1986.
	References: 1. David F. Rogers , Procedural Elements for Computer Graphics, Tata McGraw Hill, 2001. 2. M. Sonka, V. Hlavac, and R. Boyle, Image Processing, Analysis, and Machine Vision, Thomson India Edition, 2007. 3. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Pearson, 2017

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
MA 101	Engineering Mathematic I	Basic familiarity with calculus and linear algebra	S1
CS 105	Introduction to Computing and Problem Solving	Programming skills	S3

COURSE OBJECTIVES:

	• To introduce concepts of graphics input and display devices. • To discuss line and circle drawing algorithms. • To introduce 2D and 3D transformations and projections. • To introduce fundamentals of image processing.

COURSE OUTCOMES:

CS401.1	The Students will be able to compare various graphics devices
CS401.2	The Students will be able to analyze and implement algorithms for line drawing, circle drawing and polygon filling
CS401.3	The Students will be able to apply geometrical transformation on 2D and 3D objects
CS401.4	The Students will be able to analyze and implement algorithms for clipping
CS401.5	The Students will be able to apply various projection techniques on 3D objects
CS401.6	The Students will be able to summarize visible surface detection methods
CS401.7	The Students will be able to interpret various concepts and basic operations of image processing

CO-PO AND CO-PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CS401.1	3					1							3		
CS401.2		3	2										3	3	
CS401.3	3		2										3		
CS401.4	3		2										3	3	
CS401.5	3	2	2										3		
CS401.6	2	2											3		
CS401.7	2		2	1	1								3		2
CS401 (overall level)	**3**	**2**	**2**	**1**	**1**	**1**							**3**	**3**	2

JUSTIFATIONS FOR CO-PO MAPPING

Mapping	**LOW/MEDIUM /HIGH**	**Justification**

CS401.1-PO1	H	Students will be able to understand the basic working principles of graphics devices.
CS401.1-PO6	L	They can use the knowledge on graphics devices to select resources to various engineering activities.
CS401.1-PSO1	H	Students will be able to understand the concepts of computer graphics and the devices used.
CS401.2-PO2	H	Students can analyzing various algorithms of circle and line drawing by considering principles of mathematics.
CS401.2-PO3	M	Students can use the algorithms to design various graphics applications
CS401.2-PSO1	H	Students will be able to understand the concepts of drawing basic primitives like line, circle etc.
CS401.2-PSO2	H	Students will get the ability to acquire programming efficiency by studying the basic primitive drawing algorithms in software project development.
CS401.3-PO1	H	Students will be able to apply the basics of mathematics to study the concepts of geometric transformation on objects.
CS401.3-PO3	M	Students can design graphics applications like animation by applying the transformation steps on objects.
CS401.3-PSO1	H	Students will be able to understand the concepts transformation on 2d and 3d objects
CS401.4-PO1	H	Students can apply mathematics and engineering fundamentals to study the concept of clipping.
CS401.4-PO3	M	Students will be able to apply the process of clipping to graphics applications.
CS401.4-PS01	H	Students can analyze various clipping techniques and can understand the concept of clipping on different type of objects.
CS401.4-PSO2	H	Students will be able to implement the clipping algorithm using graphics programming languages and can use this to design various applications.
CS401.5-PO1	H	Students can apply mathematics and engineering fundamentals to study the concept projection of 3D objects to 2D plane.
CS401.5-PO2	M	Students can analyze the projection techniques using the principles of mathematics.
CS401.5-PO3	M	Projection techniques can be used for designing software and hardware graphics systems.
CS401.6-PO1	M	Students will be able to understand the basic concepts in visible surface detection techniques.
CS401.6-PO2	M	Students can analyze various techniques of visible surface detection using the principles of mathematics.
CS401.6-PSO1	H	Students can analyze various surface detection techniques and able to understand the concept of eliminating hidden surface

CS401.7-PO1	M	Students will be able to understand the basic concept of image processing and its application by using the basic engineering and mathematics principles.
CS401.7-PO3	M	Students can design various image processing application system using the basic knowledge on image processing
CS401.7-PO5	L	Students will be able to use image processing tools like MATLAB, OpenCV to design application programs.
CS401.7-PSO1	H	Students will be able to understand the concepts of image processing techniques.
CS401.7-PSO3	M	Students will be able to design and develop innovative products by applying the concepts of image processing.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Overview of Graphics tools	Learning Material Provided	PO5
2	OpenGL programming	Demonstration of program	PO3

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SNO	TOPICS	PROPOSED ACTIONS	PO MAPPING
1	Spline Representation - Bezier Curve and B Spline Curve	Assignment	PO1
2	Graphics and human perception	Learning Material Provided	PO3
3	Concepts on Computer Vision	Learning Material Provided	PO1

WEB SOURCE REFERENCES:

1	http://classes.soe.ucsc.edu/cmps203/Fall04/finalreports/ProjectPaper_JerryYee.pdf
2	cs.brown.edu/~morgan/evolver/ESOP_Talk.ppt
3	http://oreilly.com/news/graphics/prog_lang_poster.pdf
4	http://en.wikipedia.org/wiki/List_of_3D_graphics_libraries
5	http://www.youtube.com/watch?v=U2fa8-TtV0w
6	http://www.mit.edu/~jpfautz/jpfautz-thesis.pdf
7	http://groups.csail.mit.edu/graphics/pubs/thesis_jcyang.pdf
8	http://www.cs.umd.edu/~djacobs/CMSC427/ImageBasedRendering.pdf
9	http://graphics.stanford.edu/papers/light/light-lores-corrected.pdf
10	http://inst.eecs.berkeley.edu/~cs294-13/fa09/lectures/scribe-lecture8.pdf

SWAYAM/NPTEL Course Material

Sl.No	Course Name	Active Link	Duration
1	Computer Graphics	https://nptel.ac.in/courses/106/103/106103224/	8 Week

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐CHALK & TALK✓	☐STUD. ASSIGNMENT✓	☐WEB RESOURCES✓
☐LCD/SMART BOARDS✓	☐STUD. SEMINARS✓	☐ ADD-ON COURSES✓

ASSESSMENT METHODOLOGIES-DIRECT

☐ASSIGNMENTS✓	☐STUD. SEMINARS✓	☐TESTS/MODEL EXAMS✓	☐UNIV. EXAMINATION✓
☐ STUD. LAB PRACTICES✓	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☐ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE) ✓	☐STUDENT FEEDBACK ON FACULTY (ONCE) ✓
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by

Ms. Dincy Paul

Mr. Ajith S

Approved by

Dr. Dhanya P M

Assignment

1. Describe in detail about Interactive graphics devices and its working principle.
2. Study the concept of Spline representation, Bezier Curve and B Spline Curve.

Tutorial Questions

1. The triangle Q is defined by the points a(2,6), b(2,10), c(6,8). Using transformation matrix, scale the triangle Q with scaling factors Sx= 2 and Sy=3 with respect to a fixed point (2,2).

2. Illustrate the working of DDA Line drawing algorithm for the following line end points
   a) (2,3) – (8,15)
   b) (2,2) – (10,5)
   c) (2,10) - (10,4)

3. Using Bresenham's line drawing algorithm plot a line with end point (20,10) and (30,18).

4. Using transformation matrix, firstly translate the point (2,6) by 4 in X direction and then rotate it anticlockwise by 90 degree about (0,0).
5. Consider the line from (0, 0) to (-8,-4), use general Bresenham's line algorithm to rasterize this line. Evaluate and tabulate all the steps involved.

CS403 Programming Paradigms

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE AND ENGINEERING**	DEGREE: **BTECH**
COURSE: **PROGRAMMING PARADIGMS**	SEMESTER: **VII** CREDITS: **3**
COURSE CODE: **CS403** REGULATION:**2016**	COURSE TYPE:**CORE**
COURSEAREA/DOMAIN: **PROGRAMMING**	CONTACT HOURS: **3-0-0 (L-T-P) hours/week.**
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	LAB COURSE NAME: N.A.

SYLLABUS:

MODULE	DETAILS	HOURS
I	Names, Scopes and Bindings:-Names and Scopes, Binding Time, Scope Rules, Storage Management, Binding of Referencing Environments. Control Flow: - Expression Evaluation, Structured and Unstructured Flow, Sequencing, Selection, Iteration, Recursion, Non-determinacy.	7
II	Data Types:-Type Systems, Type Checking, Records and Variants, Arrays, Strings, Sets, Pointers and Recursive Types, Lists, Files and Input/Output, Equality Testing and Assignment.	7
III	Subroutines and Control Abstraction: - Static and Dynamic Links, Calling Sequences, Parameter Passing, Generic Subroutines and Modules, Exception Handling, Co-routines.	7
IV	Functional and Logic Languages:- Lambda Calculus, Overview of Scheme, Strictness and Lazy Evaluation, Streams and Monads, Higher-Order Functions, Logic Programming in Prolog, Limitations of Logic Programming.	7
V	Data Abstraction and Object Orientation:-Encapsulation, Inheritance, Constructors and Destructors, Aliasing, Overloading, Polymorphism, Dynamic Method Binding, Multiple Inheritance. Innovative features of Scripting Languages:-Scoping rules, String and Pattern Manipulation, Data Types, Object Orientation.	7
VI	Concurrency:-Threads, Synchronization. Run-time program Management:- Virtual Machines, Late Binding of Machine Code, Reflection, Symbolic Debugging, Performance Analysis.	7
TOTAL HOURS		**42**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Scott M L, Programming Language Pragmatics, 3rd Edn., Morgan Kaufmann Publishers, 2009.

R	David A Watt, Programming Language Design Concepts, Wiley Dreamtech, 2004
R	Ghezzi C and M. Jazayeri, Programming Language Concepts, 3rd Edn, Wiley.1997
R	Kenneth C Louden, Programming Languages: Principles and Practice, 3rd Edn., Cengage Learning, 2011.
R	Pratt T W, M V Zelkowitz, and T. V. Gopal, Programming Languages: Design and Implementation, 4th Edn., Pearson Education, 2001
R	R W Sebesta, Concepts of Programming Languages, 11th Edn., Pearson Education, 2015
R	Ravi Sethi, Programming Languages: Concepts & Constructs, 2nd Edn., Pearson Education, 2006
R	Tucker A B and R E Noonan, Programming Languages: Principles and Paradigms, 2nd Edn, McGraw Hill, 2006.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
EST102	Programming in C	To get a basic idea about programming and problem solving	2
CS205	Data Structures	To get a basic idea about stack, heap, linked lists and other abstract data types.	3
CS303	System Software	To make students understand the design concepts of various system software like Assembler, Linker, Loader and Macro pre-processor.	5

COURSE OBJECTIVES:

1	To introduce the basic constructs that underlie all programming languages.
2	To introduce the basics of programming language design and implementation.
3	To introduce the organizational framework for learning new programming languages.

COURSE OUTCOMES:

Sl No	DESCRIPTION	Blooms' Taxonomy Level

C403.1	Students will be able to compare scope and binding of names in different programming languages.	Understand (level 1)
C403.2	Students will be able to analyze control flow structures in different programming languages.	Analyze (level 3)
C403.3	Students will be able to appraise data types in different programming languages.	Understand (level 1)
C403.4	Students will be able to analyze different control abstraction mechanisms.	Analyze (level 3)
C403.5	Students will be able to appraise constructs in functional, logic and scripting languages.	Understand (level 1)
C403.6	Students will be able to analyze object oriented constructs in different programming languages.	Analyze (level 3)
C403.7	Students will be able to compare different concurrency constructs.	Understand (level 1)
C403.8	Students will be able to interpret the concepts of run-time program management.	Apply (level 2)

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C403.1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C403.2	2	1	-	-	-	-	-	-	-	-	-	1	1	1	-
C403.3	1	-	-	-	-	-	-	-	-	-	-	1	-	1	-
C403.4	2	1	-	1	-	-	-	-	-	-	-	-	2	-	-
C403.5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C403.6	2	1	-	1	-	-	-	-	-	-	-	1	2	1	-

C403.7	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-
C403.8	2	1	-	1	-	-	-	-	-	-	-	1	1	-	1
C403	1.5	1	-	1	-	-	-	-	-	-	-	1	1.5	1	1

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SLNO	DESCRIPTION	PROPOSED ACTIONS	PO
1	No practical sessions	Conduct practical sessions/home assignments	PO1, PO2, PO3, PO4, PO9, PO12

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/NPTEL ETC

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/HIGH	JUSTIFICATION
C403.1-PO1	L	The students will be able to gain a thorough understanding of the scope and binding of names.
C403.2-PO1	M	The students will be able to gain a thorough understanding of the various control flow structures in various programming languages.
C403.2-PO2	L	The students will develop the ability to identify and analyze complex engineering problems in programming by understanding the core principles and concepts.
C403.2-PO12	L	The students will be able to analyze the control flow structures in various programming languages, and indulge in lifelong learning.
C403.2-PSO1	L	The students will be able to develop the ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of programming.
C403.2-PSO2	L	The students will be able to gain the ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.

C403.3-PO1	L	The students will be able to gain a thorough understanding of the various data types used in programming languages.
C403.3-PO12	L	The students will be able to analyze the data types used in various programming languages, and indulge in lifelong learning.
C403.3-PSO2	L	The students will be able to gain the ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.
C403.4-PO1	M	The students will be able to gain a thorough understanding of the control abstraction mechanisms.
C403.4-PO2	L	The students will be able to identify, formulate, review research literature, and analyze complex engineering problems, using programming, reaching substantiated conclusions.
C403.4-PO4	L	The students will be able to use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
C403.4-PSO1	M	The students will be able to develop the ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of programming.
C403.5-PO1	L	The students will be able to gain a thorough understanding of the constructs in functional, logic, and scripting languages.
C403.6-PO1	M	The students will be able to gain a thorough understanding of the object oriented constructs in various programming languages.
C403.6-PO2	L	The students will be able to identify, formulate, review research literature, and analyze complex engineering problems, using programming, reaching substantiated conclusions.
C403.6-PO4	L	The students will be able to use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
C403.6-PO12	L	The students will be able to analyze the object oriented constructs in various programming languages, and indulge in lifelong learning.
C403.6-PSO1	M	The students will be able to develop the ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the

		core principles and concepts of programming.
C403.6-PSO2	L	The students will be able to gain the ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.
C403.7-PO1	L	The students will be able to gain a thorough understanding of the concurrency constructs.
C403.7-PO12	L	The students will be able to analyze the concurrency constructs in various programming languages, and indulge in lifelong learning.
C403.8-PO1	M	The students will be able to gain a thorough understanding of the concepts of run-time program management.
C403.8-PO2	L	The students will be able to identify, formulate, review research literature, and analyze complex engineering problems, using programming, reaching substantiated conclusions.
C403.8-PO4	L	The students will be able to use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
C403.8-PO12	L	The students will be able to interpret the concepts of run-time program management, and indulge in lifelong learning.
C403.8-PSO1	L	The students will be able to develop the ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of programming.
C403.8-PSO3	L	The students will be able to develop the ability to apply the fundamentals of computer science in competitive research.

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SLNO	DESCRIPTION	PROPOSED ACTIONS	PO
1	Semantic Analysis	Notes/References to be provided	PO2, PO4
2	Code Generation	Notes/References to be provided	PO2, PO4

WEB SOURCE REFERENCES:

1	https://en.wikipedia.org/wiki/Programming_paradigm
2	http://cs.lmu.edu/~ray/notes/paradigms/
3	https://www.cs.bham.ac.uk/research/projects/poplog/paradigms_lectures/lecture1.html
4	https://www.purplezeus.com/programming-paradigms.html
5	https://www.youtube.com/watch?v=Ps8jOj7diA0
6	https://www.youtube.com/watch?v=jTSvthW34GU

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	☑ LCD/SMART BOARDS
☑ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**

Dr. Renu Mary Daniel 

Dr. Jisha G.

(Faculty)

Dr. Dhanya P M

(HOD)

CS405 Computer System Architecture

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE & ENGINEERING**	DEGREE: **BTECH (AUGUST- DECEMBER2021)**
COURSE: **COMPUTER SYSTEM ARCHITECTURE**	SEMESTER: **VII** CREDITS: **3**
COURSE CODE: **CS405** REGULATION: **2016**	COURSE TYPE: **CORE**
COURSEAREA/DOMAIN: **COMPUTER HARDWARE**	CONTACT HOURS: **3 hours/week.**
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME:

SYLLABUS:

MODULE	DETAILS	HOURS
I	Parallel computer models – Evolution of Computer Architecture, System Attributes to performance, Amdahl's law for a fixed workload. Multiprocessors and Multicomputers, Multivector and SIMD computers, Architectural development tracks, Conditions of parallelism.	**6**
II	Processors and memory hierarchy – Advanced processor technology- Design Space of processors, Instruction Set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar and vector processors, Memory hierarchy technology.	**8**
III	Multiprocessors system interconnects - Hierarchical bus systems, Cross bar switch and multiport memory, Multistage and combining networks. Cache Coherence and Synchronization Mechanisms, Cache Coherence Problem, Snoopy Bus Protocol, Directory Based Protocol, Hardware Synchronization Problem	**7**
IV	Message Passing Mechanisms-Message Routing schemes, Flow control Strategies, Multicast Routing Algorithms. Pipelining and Superscalar techniques – Linear Pipeline processors and Nonlinear pipeline processors	**8**
V	Instruction pipeline design, Arithmetic pipeline deign -Super Scalar Pipeline Design	**8**
VI	Multithreaded and data flow architectures - Latency hiding techniques, Principles of multithreading – Multithreading Issues and Solutions, Multiple context Processors, Fine-grain Multicomputer- Fine-grain Parallelism. Dataflow and hybrid architecture	**8**
	TOTAL HOURS	**45**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	K. Hwang and Naresh Jotwani, Advanced Computer Architecture, Parallelism, Scalability, Programmability, TMH, 2010.
R	H P Hayes, Computer Architecture and Organization, McGraw Hill, 1978.

R	K. Hwang & Briggs, Computer Architecture and Parallel Processing, McGraw Hill International, 1986
R	M J Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House, 2012.
R	M Sasikumar, D Shikkare and P Raviprakash, Introduction to Parallel Processing, PHI, 2014.
R	P M Kogge, The Architecture of Pipelined Computer, McGraw Hill, 1981.
R	P V S Rao, Computer System Architecture, PHI, 2009.
R	Patterson D. A. and Hennessy J. L., Morgan Kaufmann, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann Pub, 4/e, 2010.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
CS202	Computer Organization and Architecture	Basics related to hardware	**S4**
CS305	Microprocessors and Microcontrollers	Basics related to hardware	**S5**

COURSE OBJECTIVES:

1	To impart a basic understanding of the parallel architecture and its operations
2	To introduce the key features of high-performance computers

COURSE OUTCOMES:

Sl No	DESCRIPTION	Blooms' Taxonomy Level
CS405.1	Summarize different parallel computer models	Level 2
CS405.2	Analyze the advanced processor technologies	Level 4
CS405.3	Interpret memory hierarchy	Level 2
CS405.4	Compare different multiprocessor system interconnecting mechanisms	Level 4

CS405.5	Interpret the mechanisms for enforcing cache coherence	Level 2
CS405.6	Analyze different message passing mechanisms	Level 4
CS405.7	Analyze different pipelining techniques	Level 4
CS405.8	Appraise concepts of multithreaded and data flow architectures	Level 5

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C405.1	2												2	2	
C405.2		3											2		2
C405.3		2		3									2		
C405.4		3			3								2	2	2
C405.5		3											2		2
C405.6		3	3										2	2	
C405.7		3	3										2	2	
C405.8			3										2		2
CS405(Overall Level)	2	2.8	3	3	3								2	2	2

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/HIGH	JUSTIFICATION
CS405.1- PO1	M	Students gain the ability to form the foundations for designing high performance computers and for the development of supporting software and applications
CS405.2- PO2	H	Students are able to identify the instruction set architectures like CISC and RISC, Superscalar, VLIW, Super pipelined, Vector and Symbolic Processors
CS405.3- PO2	M	Students can analyze the parameters such as access time,

		memory size, cost per byte, transfer bandwidth, and unit of transfer in hierarchical memory technology
CS405.4- PO2	H	Students are able to identify the best interconnection mechanisms for multiprocessor system.
CS405.4- PO5	H	The students are able to select and apply the appropriate interconnection techniques for a multiprocessor system.
CS405.5- PO2	H	Students will be able to identify the appropriate mechanisms used for enforcing cache coherence.
CS405.6- PO2	H	Students will be able to identify and analyse different message passing mechanisms.
CS405.6- PO3	H	Students will be able to develop solutions for multicomputer message passing mechanisms by analyzing different schemes used in it.
CS405.7- PO2	H	Students will be able to analyse the performance of superpipelining and superscalar design techniques.
CS405.7- PO3	H	Students will be able to design and develop specific techniques for building instruction pipelines, arithmetic pipelines etc
CS405.8- PO3	H	Students will be able to develop massively parallel processing systems (MPP) once they understand the concepts of multithreaded and dataflow architectures.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

S. NO	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Pipelining	Assignment	7

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

S. NO	TOPIC	PO MAPPING
1	Representative Systems for CISC and RISC	2

WEB SOURCE REFERENCES:

1	http://www.icsa.inf.ed.ac.uk/research/groups/hase/models/coherence/index.html
2	https://www.techopedia.com/webinars
3	https://onlinecourses.nptel.ac.in/noc18_cs29/preview
4	https://www.tutorialspoint.com/parallel_computer_architecture
5	http://ecomputernotes.com/fundamental/disk-operating-system/parallel-processing-systems
6	http://abhaycopi.blogspot.com/2014/04/instruction-pipeline.html

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑CHALK & TALK	☑STUD. ASSIGNMENT	☑WEB RESOURCES	☑LCD/SMART BOARDS
☑STUD. SEMINARS	☐ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ASSIGNMENTS	☑STUD. SEMINARS	☑TESTS/MODEL EXAMS	☑UNIV. EXAMINATION
☑STUD. LAB PRACTICES	☐STUD. VIVA	☐MINI/MAJOR PROJECTS	☐CERTIFICATIONS
☐ADD-ON COURSES	☐OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑STUDENT FEEDBACK ON FACULTY (TWICE)
☐ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐OTHERS

Prepared by
Ms. Jomina John/ Mr. Harikrishnan M
(Faculty)

Approved by
Dr. Dhanya P M
(HOD)

CS407 Distributed Computing

COURSE INFORMATION SHEET

PROGRAMME: COMPUTER SCIENCE AND ENGINEERING	DEGREE: BTECH YEAR: **SEPTEMBER 2021 – JANUARY 2022**
COURSE: DISTRIBUTED COMPUTING	SEMESTER: VII CREDITS: 3
COURSE CODE:CS407	COURSE TYPE: CORE
REGULATION:2016	
COURSE AREA/DOMAIN: NETWORKING & COMMUNICATION	CONTACT HOURS: 3.
CORRESPONDING LAB COURSE CODE (IF ANY):Nil	LAB COURSE NAME: Nil

SYLLABUS:

UNIT	DETAILS	HOURS
I	Evolution of Distributed Computing -Issues in designing a distributed system- Challenges- Minicomputer model –Workstation model - Workstation-Server model–Processor - pool model - Trends in distributed systems	7
II	System models: Physical models - Architectural models -Fundamental models	6
III	Interprocess communication: characteristics – group communication - Multicast Communication –Remote Procedure call - Network virtualization. Case study :Skype	7
IV	Distributed file system: File service architecture – Network file system- Andrew file system- Name Service	7
V	Transactional concurrency control:- Transactions, Nested transactions-Locks- Optimistic concurrency control	7
VI	Distributed mutual exclusion – central server algorithm –ring based algorithm- Maekawa's voting algorithm –Election: Ring -based election algorithm – Bully algorithm	7
	TOTAL HOURS	41

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	1. George Coulouris, Jean Dollimore and Tim Kindberg , Distributed Systems:Concepts and Design, Fifth Edition , Pearson Education, 2011
T	2. Pradeep K Sinha, Distributed Operating Systems : Concepts and Design, Prentice Hall of India
R	**References:** 1. A S Tanenbaum and M V Steen , Distributed Systems: Principles and paradigms, Pearson Education, 2007
R	2. M Solomon and J Krammer, Distributed Systems and Computer Networks, PHI

COURSE PRE-REQUISITES:

COURSE NAME	DESCRIPTION	SEM
DATABASE MANAGEMENT SYSTEMS	Study of distributed database management systems	S4
COMPUTER NETWORKS	Study of different distributed computing models, communication techniques used in distributed systems.	S6
OPERATING SYSTEMS	Study of process migration, threads, mutual exclusion	S4

COURSE OBJECTIVES:

1	To introduce fundamental principles of distributed systems, technical challenges and key design issues.
2	To impart knowledge of the distributed computing models, algorithms and the design of distributed system.

COURSE OUTCOMES:

Students will be able to:

1.	**distinguish** distributed computing paradigm from other computing paradigms (level 2)
2.	**identify** the core concepts of distributed systems (level 1)
3.	**illustrate** the mechanisms of inter process communication in distributed system (level 3)
4.	**apply** appropriate distributed system principles in ensuring transparency ,consistency and fault-tolerance in distributed file system (level 3)
5.	**compare** the concurrency control mechanisms in distributed transactional environment (level 4)
6.	**outline** the need for mutual exclusion and election algorithms in distributed systems (level 4)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-	2	-	-
3	-	-	-	-	2	-	-	-	-	-	-	-	2	-	-
4	1	-	-	-	-	1	-	-	-	-	-	-	2	-	-
5	-	2	-	-	-	-	-	-	-	-	-	-	2	-	-
6	-	2	-	-	-	-	-	-	-	-	-	-	1	-	-
	1	2			2	1							1.8		

JUSTIFATIONS FOR CO-PO MAPPING

Mapping	**LOW/MEDIUM/HIGH**	**Justification**
CO1-PO2	L	The subject contributes to the program outcome by providing opportunity to students to compare distributed systems and other computing paradigms.
CO2-PO2	H	The subject contributes to the program outcome by providing knowledge about core concepts of distributed systems.
CO3-PO5	H	The subject contributes to the program outcome by providing opportunity to students for examine the working behind Skype.
CO4-PO1	H	This subject contributes to the program outcome by providing opportunity to students to study the distributed system principles in ensuring transparency. Concurrency and fault tolerance in DFS.
CO5-PO2	M	Knowledge in differentiating different concurrency control mechanisms to choose the best methods for a particular application.
CO6-PO2	M	This subject contributes to the program outcome by providing opportunity to students to identify the needs for mutual exclusion and election algorithms in implementing distributed systems.

Assignments

1	Distinguish distributed computing paradigm from other computing paradigms	CO1

2	Case study : Skype	CO3

Gaps in the syllabus

1	Case study :Google file System and WWW.	CO3

WEB SOURCE REFERENCES:

1	http://billpg.com/bacchae-co-uk/docs/dist.html
2	https://www.coursera.org/lecture/cloud-computing/2-2-what-is-a-distributed-system-nvMXE
3	https://www.distributed-systems.net/index.php/books/distributed-systems-3rd-edition-2017/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

▫CHALK & TALK	▫STUD. ASSIGNMENT	▫WEB RESOURCES	
▫LCD/SMART BOARDS	STUD. SEMINARS	ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

▫ASSIGNMENTS	STUD. SEMINARS	▫TESTS/MODEL EXAMS	▫UNIV. EXAMINATION
STUD. LAB PRACTICES	STUD. VIVA	MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

▫ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	▫STUDENT FEEDBACK ON FACULTY (ONCE)
ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	OTHERS

Prepared by **Approved by**

Paul Augustine
Renu Mary Daniel

Dr Dhanya P M
HOD

CS409 Cryptography and Network Security

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE AND ENGINEERING**	**DEGREE: BTECH**
COURSE: **CRYPTOGRAPHY AND NETWORK SECURITY**	SEMESTER: VII CREDITS: 3
COURSE CODE: **CS409** REGULATION: 2015	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: PROBLEM SOLVING	CONTACT HOURS: **3 hours/Week.**
CORRESPONDING LAB COURSE CODE (IF ANY): N.A	LAB COURSE NAME: N.A

SYLLABUS:

UNIT	DETAILS	HOURS
I	Symmetric Cipher Models- Substitution techniques- Transposition techniques- Rotor machines-Steganography. Simplified DES- Block Cipher principles- The Data Encryption Standard, Strength of DES, Differential and linear Cryptanalysis. Block Cipher Design principles- Block Cipher modes of operations.	7
II	IDEA: Primitive operations- Key expansions- One round, Odd round, Even Round- Inverse keys for decryption. AES: Basic Structure- Primitive operation- Inverse Cipher- Key Expansion, Rounds, Inverse Rounds. Stream Cipher –RC4.	7
III	Public key Cryptography: - Principles of Public key Cryptography Systems, Number theory- Fundamental Theorem of arithmetic, Fermat's Theorem, Euler's Theorem, Euler's Totient Function, Extended Euclid's Algorithm, Modular arithmetic. RSA algorithm-Key Management - Diffie-Hellman Key Exchange, Elliptic curve cryptography	7
IV	Authentication requirements- Authentication functions- Message authentication codes- Hash functions- SHA -1, MD5, Security of Hash functions and MACs- Authentication protocols-Digital signatures-Digital signature standards.	7
V	Network security: Electronic Mail Security: Pretty good privacy-S/MIME. IP Security: Architecture- authentication Header- Encapsulating Security payload- Combining Security associations- Key management.	7
VI	Web Security: Web Security considerations- secure Socket Layer and Transport layer Security- Secure electronic transaction. Firewalls-Packet filters- Application Level Gateway- Encrypted tunnels.	7
	TOTAL HOURS	42

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill. 2010
T	William Stallings, Cryptography and Network Security, Pearson Education, 2014
R	B. Schneier , Applied Cryptography, Protocols, Algorithms, and Source Code in C, 2 nd Edn, Wiley, 1995.

R	Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, PHI, 2002

COURSE PRE-REQUISITES: NIL

COURSE OBJECTIVES:

1	To introduce fundamental concepts of symmetric and asymmetric cipher models..
2	To introduce fundamental concepts of authentication.
3.	To introduce network security and web security protocols.

COURSE OUTCOMES:

Students will be able to

CS409.1	summarize different classical encryption techniques (Level 3)
CS409.2	identify mathematical concepts for different cryptographic algorithms. (Level 4)
CS409.3	demonstrate cryptographic algorithms for encryption/key exchange(Level 4)
CS409.4	summarize different authentication and digital signature schemes.(Level 3)
CS409.5	identify security issues in network, transport and application layers and outline appropriate security protocols (Level 4)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS409.1	3	-	3	-	2	-	-	-	-	-	-	-	2	-	-
CS409.2	3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CS409.3	2	2	3	2	2	-	-	-	-	-	-	1	2	-	-
CS409.4	3	2	2	2	2	-	-	-	-	-	-	1	2	-	-
CS409.5	3	2	2	2	2	-	-	-	-	-	-	1	3	-	-
CS409(overall level)	**3**	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**-**		**-**	**1**	**2**	**-**	**-**

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
CS409.1-PO1	H	The knowledge in classical encryption techniques helps to

		understand the basics of encryption which helps to solve complex engineering problems from the security perspective
CS409.1-PO3	H	The knowledge of classical encryption techniques helps to apply the techniques studied in these algorithms to design secure solutions to complex problems.
CS409.1-PO5	M	The knowledge of classical encryption techniques helps to select appropriate technique to secure complex engineering activities and also to choose the best technique understanding the limitations of other techniques.
CS409.1-PSO1	M	The knowledge of classical encryption techniques helps to identify, analyze and design solutions in a secure manner.
CS409.2-PO1	H	The study of mathematical concepts for different cryptographic algorithms helps to apply that knowledge to provide security solutions to complex engineering problems.
CS409.2-PO2	H	The study of mathematical concepts for different cryptographic algorithms helps to identify and analyze engineering problems thereby providing valid conclusions using mathematical proofs.
CS409.2-PO3	M	The study of mathematical concepts for different cryptographic algorithms helps to design efficient solutions for complex problems from a security perspective.
CS409.2-PO4	H	The study of mathematical concepts for different cryptographic algorithms helps to use them to analyze and interpret data and reach valid conclusion by proving them using the mathematical principles studied.
CS409.2-PO12	M	The study of mathematical concepts for different cryptographic algorithms helps to indulge in lifelong learning and use it to develop new cryptographic algorithms for various applications.
CS409.2-PSO1	M	The study of mathematical concepts for different cryptographic algorithms helps to apply these concepts in designing secure solutions to complex problems using cryptographic algorithms.
CS409.3-PO1	M	The knowledge about encryption and key exchange algorithms helps to apply the knowledge to provide security solutions to complex engineering problems.
CS409.3-PO2	M	The knowledge about encryption and key exchange algorithms helps to analyze the problems from a security stand point and reach valid conclusions by applying these algorithms
CS409.3-PO3	H	The knowledge about encryption and key exchange algorithms helps to design security solutions for encryption/ key exchange for complex engineering problems.
CS409.3-PO4	M	The knowledge about encryption and key exchange algorithms helps to understand how to develop new algorithms and thereby apply the knowledge in research based activities for developing new algorithms.
CS409.3-PO5	M	The knowledge about encryption and key exchange algorithms helps to use them to create modern tools for complex engineering problems

CS409.3-PO12	L	The knowledge about encryption and key exchange algorithms helps to engage in independent learning and development of new secure applications.
CS409.3-PSO1	M	The knowledge about encryption and key exchange algorithms helps to design software security solutions to complex engineering problems which can be considered as a computer science specific skill.
CS409.4-PO1	H	The knowledge about authentication and digital signature schemes helps to apply that knowledge in solving the security aspects of complex
CS409.4-PO2	M	The knowledge about authentication and digital signature schemes helps to analyze the security aspects of complex engineering problems and use these algorithms in reaching valid conclusions.
CS409.4-PO3	M	The knowledge about authentication and digital signature schemes helps to design security based solutions for including authentication and digital signatures to complex engineering problems.
CS409.4-PO4	M	The knowledge about authentication and digital signature schemes helps to design new methods and thereby involve in the research of new authentication and digital signature techniques.
CS409.4-PO5	M	The knowledge about authentication and digital signature schemes helps to use them to create modern security tools for complex engineering problems
CS409.4-PO12	L	The knowledge about authentication and digital signature schemes helps to indulge in lifelong learning activities to develop new techniques for authentication and digital signature schemes.
CS409.4-PSO1	M	The knowledge about authentication and digital signature schemes helps to design software solutions for handling the authentication aspects of complex problems.
CS409.5-PO1	H	The ability to identify security issues in network, transport and application layers and outline appropriate security protocols is important to apply that knowledge in solving complex security issues in different applications
CS409.5-PO2	M	The ability to identify security issues in network, transport and application layers and outline appropriate security protocols helps to analyze problems and reach substantiated conclusions based on this knowledge
CS409.5-PO3	M	The ability to identify security issues in network, transport and application layers and outline appropriate security protocols helps to develop and design security solutions using the apt security protocols based on which layer the problem occurs.
CS409.5-PO4	M	The ability to identify security issues in network, transport and application layers and outline appropriate security protocols helps to conduct investigations of complex problems and analyze how to

		solve them using the knowledge of security protocols in each layer.
CS409.5-PO5	M	The ability to identify security issues in network, transport and application layers and outline appropriate security protocols helps to develop/ create new tools for securing the network applications.
CS409.5-PO12	L	The ability to identify security issues in network, transport and application layers and outline appropriate security protocols helps to indulge in lifelong learning trying to design new protocols for securing the network layers for a better technological change.
CS409.5-PSO1	H	The ability to identify security issues in network, transport and application layers and outline appropriate security protocols helps to design software solutions for designing or improving the security protocols.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS
1		
2		

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

1	

WEB SOURCE REFERENCES:

1	Introduction to Cryptography by Christof Paar, https://www.youtube.com/channel/UC1usFRN4LCMcfIV7UjHNuQg/videos

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ CHALK & TALK	✓ STUD. ASSIGNMENT	✓ WEB RESOURCES	
✓ LCD/SMART BOARDS	STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

✓ ASSIGNMENTS	☐ STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
STUD. LAB PRACTICES	✓ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON	☐ OTHERS		

COURSES			

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**

HOD

Anita John

Sandy Joseph

CS463 Digital Image Processing

COURSE INFORMATION SHEET

PROGRAMME: **Computer Science and Engineering**	DEGREE: **B TECH** YEAR: **2018-2019**
COURSE: **DIGITAL IMAGE PROCESSING**	SEMESTER: **7** CREDITS: **3**
COURSE CODE: **CS463** REGULATION: **2015**	COURSE TYPE: **ELECTIVE**
COURSE AREA/DOMAIN: **DIGITAL IMAGE PROCESSING**	CONTACT HOURS: **3hours/Week.**
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME:

SYLLABUS:

UNIT	DETAILS	HOURS
I	Introduction to Image processing: Fundamental steps in image processing; Components of image processing system; Pixels; coordinate conventions; Imaging Geometry; Spatial Domain; Frequency Domain; sampling and quantization; Basic relationship between pixels; Applications of Image Processing	6
II	Image transforms and its properties – Unitary transform; Discrete Fourier Transform; Discrete Cosine Transform;Walsh Transform; Hadamard Transform;	7
III	Image Enhancement in spatial domain Basic Gray Level Transformation functions – Image Negatives; Log Transformations; Power-Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching; Gray Level Slicing; Bit Plane Slicing; Histogram Processing– Equalization; Specification. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters; Ordered Statistic Filters; Sharpening: Laplacian; Unsharp Masking and High Boost Filtering.	8
IV	Image Enhancement in Frequency Domain Basics of Filtering in Frequency Domain, Filters - Smoothing Frequency Domain Filters : Ideal Low Pass Filter; Gaussian Low Pass Filter; Butterworth Low Pass Filter; Sharpening Frequency Domain Filters: Ideal High Pass Filter; Gaussian High Pass Filter; Butterworth High Pass Filter; Homomorphic Filtering.	6
V	Image Segmentation: Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method; Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators; Line Detection, Corner Detection.	8
VI	Morphological Operations Basics of Set Theory; Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing; Hit or Miss Transformation. Representation and Description Representation - Boundary, Chain codes, Polygonal approximation approaches, Boundary segments.	7
		42

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	A K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
T2	2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (English) 3rd Edition,
R1	Al Bovik, The Essential Guide to Image Processing, Academic Press, 2009.
R2	Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, 2008.
R3	S Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Procesing, McGraw Hill Education , 2009.

COURSE PRE-REQUISITES: Nil

COURSE OBJECTIVES:

	• To introduce and discuss the fundamental concepts and applications of Digital Image Processing. • To discuss various basic operations in Digital Image Processing. • To know various transform domains.

COURSE OUTCOMES:

SNO	DESCRIPTION
463.1	Students will be able to compare different methods for image acquisition, storage and representation in digital devices and computers
463.2	Students will be able to appreciate role of image transforms in representing, highlighting, and modifying image features
463.3	Students will be able to interpret the mathematical principles in digital image enhancement and apply them in spatial domain and frequency domain
463.4	Students will be able to apply various methods for segmenting image and identifying image components
463.5	Students will be able to summarise different reshaping operations on the image and their practical applications
463.6	Students will be able to identify image representation techniques that enable encoding and decoding images.

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C463.1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	1
C463.2	2	-	-	2	-	-	-	-	-	-	-	-	2	-	1
C463.3	-	-	-	2	-	-	-	-	-	-	-	-	1	-	-
C463.4	2	-	-	-	-	-	-	-	-	-	-	-	2	-	1
C463.5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C463.6	2	-	3	-	-	-	-	-	-	-	-	-	-	-	1
CS 463 (overall level)															

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
C463.1-PO1	M	Understanding various image acquisition methods
C463.2-PO1	M	Apply the mathematical fundamentals to do various image transforms.
C463.2-PO4	M	gain the knowledge to represent the image in frequency domain.
C463.2-PSO1	M	Ability to design solutions for projects in multidisciplinary area
C463.2-PSO3	L	By understanding the image transforms, gain the knowledge to represent the image in frequency domain.
C304.3-PO4	M	Knowledge of image enhancement helps to analyze the image quality.
C304.3-PSO1	M	Ability to design solutions for projects in multidisciplinary area
C304.4-PO1	M	Apply the mathematical and engineering fundamentals to segment an image to different components that helps to analyze image thoroughly.
C304.4-PSO1	M	Apply the mathematical fundamentals to segment an image to different components that helps to do multidisciplinary projects.
C304.4-PSO3	L	A better understanding of basic segmentation techniques helps to design new segmentation algorithms.
C304.5-PO1	H	Apply the mathematical fundamentals to perform reshaping operations

C304.6-PO1	M	Knowledge of image representation techniques helps to understand compression mechanism.
C304.6-PO3	H	Knowledge of image representation techniques is useful to develop solutions to practical applications.
C304.6-PSO3	L	Knowledge of image encoding and decoding techniques helps to develop innovative products to meet the societal needs

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

S. NO	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Elements of visual perception	Lecture	1
2	Haar Transform	Lecture	1

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

S. NO	TOPIC	PO MAPPING
1	Digital image compression	1,2

Assignments

S. NO	TOPIC	CO Mapping	Level	PO MAPPING
1	Explain about the various components of image processing system	1	2	1
2	Describe about the properties of Discrete Fourier Transform	2	2	1,2
3	Describe in detail about the various polygonal approximation approaches	6	2	1,2

WEB SOURCE REFERENCES:

1	http://www.cse.iitd.ernet.in%2F~sak%2Fcourses%2Fcdp%2Fslides.pdf&ei=xl4xUsWwI8n_rQe24YDoAQ&usg=AFQjCNFeZnxu6BwhgXtl0FMEDQFq9FECzw&bvm=bv.52109249,d.bmk
2	http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/compiler-desing/
3	http://www.diku.dk/~torbenm/Basics/basics_lulu2.pdf
4	http://www.antlr.org/wiki/display/ANTLR3/Tutorials
5	http://javacc.java.net/
6	http://www.engr.mun.ca/~theo/JavaCC-Tutorial/javacc-tutorial.pdf

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD.	☑ WEB RESOURCES	

	ASSIGNMENT		
☐ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☐ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☑ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by

JINCY J FERNANDEZ

Approved by

SHIMMI ASOKAN
(HOD)

CS467 Machine Learning

COURSE INFORMATION SHEET

PROGRAMME: Computer Science & Engineering	**DEGREE**: B. Tech
COURSE: Machine Learning	**SEMESTER:** S7 **CREDITS:** 3
COURSE CODE: CS467 **REGULATION:** 2016	**COURSE TYPE:** ELECTIVE
COURSE AREA/DOMAIN: Artificial Intelligence	**CONTACT HOURS:** 3 hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME:** NIL

SYLLABUS:

UNIT	DETAILS	HOURS
1	Introduction to Machine Learning, Examples of Machine Learning applications - Learning associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning. Supervised learning- Input representation, Hypothesis class, Version space, Vapnik-Chervonenkis (VC) Dimension	**6**
2	Probably Approximately Learning (PAC), Noise, Learning Multiple classes, Model Selection and Generalization, Dimensionality reduction- Subset selection, Principle Component Analysis	**8**
3	Classification- Cross validation and re-sampling methods- Kfold cross validation, Boot strapping, Measuring classifier performance- Precision, recall, ROC curves. Bayes Theorem, Bayesian classifier, Maximum Likelihood estimation, Density functions, Regression	**8**
4	Decision Trees- Entropy, Information Gain, Tree construction, ID3, Issues in Decision Tree learning- Avoiding Over-fitting, Reduced Error Pruning, The problem of Missing Attributes, Gain Ratio, Classification by Regression (CART), Neural Networks- The Perceptron, Activation Functions, Training Feed Forward Network by Back Propagation.	**6**
5	Kernel Machines- Support Vector Machine- Optimal Separating hyper plane, Soft-margin hyperplane, Kernel trick, Kernel functions. Discrete Markov Processes, Hidden Markov models, Three basic problems of HMMs- Evaluation problem, finding state sequence, Learning model parameters. Combining multiple learners, Ways to achieve diversity, Model combination schemes, Voting, Bagging, Booting	**8**
6	Unsupervised Learning - Clustering Methods - K-means, Expectation-Maximization Algorithm, Hierarchical Clustering Methods, Density based clustering	**6**

TOTAL HOURS	**42**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
R	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
R	Ethem Alpaydın, Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press, 2004.
R	Margaret H. Dunham. Data Mining: introductory and Advanced Topics, Pearson, 2006
R	Mitchell. T, Machine Learning, McGraw Hill
R	Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Machine Learning : An Artificial Intelligence Approach, Tioga Publishing Company.

COURSE PRE-REQUISITES: Nil

COURSE OBJECTIVES:

1	To introduce the prominent methods for machine learning
2	To study the basics of supervised and unsupervised learning.
3	To study the basics of connectionist and other architectures

COURSE OUTCOMES:

Students will be able to:

Sl No.	DESCRIPTION
1	Differentiate various learning approaches, and to interpret the concepts of supervised learning.
2	Compare the different dimensionality reduction techniques.
3	Apply theoretical foundations of decision trees to identify best split and Bayesian classifier to label data points.
4	Illustrate the working of classifier models like SVM, Neural Networks and identify classifier model for typical machine learning applications.
5	Identify the state sequence and evaluate a sequence emission probability from a given HMM.
6	Illustrate and apply clustering algorithms and identify its applicability in real life problems.

CO MAPPING WITH PO, PSO

CO No.	Programme Outcomes (POs)												Programme-Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	1					1			2	1	2	
2	3	3	3	1					1			1	1	2	1
3	3	3	3	1		1			1			1	2	1	1
4	3	3	3	1					1			2	1	1	1
5	3	3	3	2									1	1	1
6	3	3	3	3									1	1	1

JUSTIFICATION FOR CO-PO-PSO CORRELATION:

MAPPING	LEVEL	JUSTIFICATION
CS467.1-PO1	3	Knowledge of various machine learning approaches involves solving complex engineering problems.
CS467.1-PO2	3	Principles of mathematics and engineering sciences are used in various aspects of machine learning approaches.
CS467.1-PO3	3	Using the knowledge of supervised learning concepts, we can design and develop solutions for complex engineering problems.
CS467.1-PO4	1	Supervised learning and VC dimension concepts can be used to design and conduct experiments to provide valid conclusions.
CS467.1-PO9	1	Expertise developed, which will enable the student to become a productive member of a design team.
CS467.1-PO12	2	The student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge.
CS467.2-PO1	3	Comparative study of different dimensionality reduction techniques involves solving complex engineering problems.
CS467.2-PO2	3	Principles of mathematics and engineering sciences are used in various aspects of dimensionality reduction techniques.
CS467.2-PO3	3	Knowledge of dimensionality reduction techniques can be used to design and develop solutions for complex engineering problems.
CS467.2-PO4	1	Dimensionality reduction techniques knowledge can be used to design and conduct experiments to provide valid conclusions.
CS467.2-PO9	1	Expertise developed, which will enable the student to become a productive member of a design team.
CS467.2-PO12	1	The student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge.
CS467.3-PO1	3	Knowledge of theoretical foundations of decision trees involves solving complex engineering problems
CS467.3-PO2	3	Principles of mathematics and engineering sciences are used in theoretical foundations of decision trees to identify best split and Bayesian classifier to label data points.

CS467.3-PO3	3	Knowledge of theoretical foundations of decision trees to identify best split can be used to design and develop solutions for complex engineering problems
CS467.3-PO4	1	Theoretical foundations of decision trees to identify best split and Bayesian classifier to label data points. knowledge can be used to design and conduct experiments to provide valid conclusions
CS467.3-PO6	1	Knowledge of theoretical foundations of decision trees to identify best split and Bayesian classifier to label data points. will help understand issues and societal problems related to cybercrimes and computer hacking
CS467.3-PO9	1	Expertise developed, which will enable the student to become a productive member of a design team
CS467.3-PO12	1	The student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge
CS467.4-PO1	3	Knowledge of classifier models' applications helps in solving complex engineering problems
CS467.4-PO2	3	Principles of mathematics and engineering sciences are used in various aspects of classifier models
CS467.4-PO3	3	Knowledge of classifier models can be used to design and develop solutions for complex engineering problems
CS467.4-PO4	1	Various classifier models' knowledge can be used to design and conduct experiments to provide valid conclusions
CS467.4-PO9	1	Expertise developed, which will enable the student to become a productive member of a design team
CS467.4-PO12	2	The student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge
CS467.5-PO1	3	Study of HMM involves solving complex engineering problems
CS467.5-PO2	3	Study of HMM involves principles of mathematics and engineering
CS467.5-PO3	3	Sequence emission probability evaluation knowledge can be used to design and develop solutions for complex engineering problems
CS467.5-PO4	2	State sequence identification and sequence emission probability evaluation skills can be used to design and conduct experiments to provide valid conclusions
CS467.6-PO1	3	Knowledge of clustering algorithms involves solving complex engineering problems
CS467.6-PO2	3	Design of clustering algorithms involves principles of mathematics and engineering
CS467.6-PO3	3	Clustering algorithms can be used to design and develop solutions for complex engineering problems
CS467.6-PO4	3	Clustering algorithms knowledge can be used to conduct experiments in real life problems to provide valid conclusions

JUSTIFICATION FOR CO-PSO MAPPING:

MAPPING	LEVEL	JUSTIFICATION
CS467.1-PSO1	1	Various learning approaches Acquire skills to design, analyze and develop algorithms and implement them using high-level programming languages.
CS467.1-PSO2	2	Knowledge of supervised learning concepts contribute skills in computing and knowledge engineering domain.
CS467.2-PSO1	1	Knowledge of different dimensionality reduction techniques Acquire skills to design, analyze and develop algorithms and implement them using high-level programming languages.
CS467.2-PSO2	2	Different dimensionality reduction techniques concepts contribute skills in computing and knowledge engineering domain.
CS467.2-PSO3	1	Knowledge of different dimensionality reduction techniques contribute to develop strong skills in developing IT solutions for different domains which helps in the betterment of life.
CS467.3-PSO1	2	Theoretical foundations of decision trees to identify best split and Bayesian classifier Acquire skills to design, analyze and develop algorithms and implement them using high-level programming languages
CS467.3-PSO2	1	Theoretical foundations of decision trees and Bayesian classifier contribute skills in computing and knowledge engineering domain
CS467.3-PSO3	1	Theoretical foundations of decision trees and Bayesian classifier techniques contribute to develop strong skills in developing IT solutions for different domains which helps in the betterment of life.
CS467.4-PSO1	1	Study of classifier model working acquire skills to design, analyze and develop algorithms and implement them using high-level programming languages
CS467.4-PSO2	1	Identification of classifier model application area contribute skills in computing and knowledge engineering domain.
CS467.4-PSO3	1	Classifier model working knowledge contribute to develop strong skills in developing IT solutions for different domains which helps in the betterment of life.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

Sl. No.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Understanding of Probability theory	Class Seminars	1, 2, 3, 4, 5, 6

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURE/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Sl. No	DESCRIPTION	PO MAPPING
1	Fuzzy logic	1, 2, 3, 4, 5, 6
2	Deep learning	

DESIGN AND ANALYSIS TOPICS:

Sl. No.	DESCRIPTION	PO MAPPING
1	Dimensionality Reduction techniques	1, 2, 3, 4, 5, 9, 10

WEB SOURCE REFERENCES:

1.	https://nptel.ac.in/courses/106/106/106106139/
2.	https://www.upgrad.com/machine-learning-and-artificial-intelligence

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☐ WEB RESOURCES	
☑ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☐ UNIV. EXAMINATION
☐STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by

Ms. Anu Maria Joykutty
(Faculty in Charge)

Approved by

Dr. Dhanya P. M.
(HoD, CSE)

CS469 Computational Complexity

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE & ENGINEERING**	DEGREE: **B TECH**
COURSE: **COMPUTATIONAL COMPLEXITY**	SEMESTER: **7** CREDITS: **3**
COURSE CODE: **CS469** REGULATION: **2016**	COURSE TYPE: **ELECTIVE**
COURSE AREA/DOMAIN:**ALGORITM AND AUTOMATA**	CONTACT HOURS: **3**
CORRESPONDING LAB COURSE CODE (IF ANY): **NA**	LAB COURSE NAME:

SYLLABUS:

UNIT	DETAILS	HOURS
I	Introduction: Easy and hard problems. Algorithms and complexity. Turing machines: Models of computation. Multi-tape deterministic and non-deterministic Turing machines. Decision problems	5
II	The Halting Problem and Undecidable Languages: Counting and diagonalization. Tape reduction. Universal Turing machine.Undecidability of halting. Reductions. Rice's theorem.Deterministic Complexity Classes: DTIME[t]. Linear Speed-up Theorem. P Time. Polynomial reducibility. Polytime algorithms: 2-satisfiability, 2-colourability.	8
III	NP and NP-completeness: Non-deterministic Turing machines.NTIME[t]. NP. Polynomial time verification. NP-completeness.Cook-Levin Theorem. Polynomial transformations: 3-satisfiability, clique, colourability, Hamilton cycle, partition problems. Pseudo-polynomial time. Strong NP-completeness. Knapsack. NP-hardness.	8
IV	Space complexity and hierarchy theorems: DSPACE[s].Linear Space Compression Theorem. PSPACE, NPSPACE.PSPACE = NPSPACE. PSPACE-completeness. QuantifiedBoolean Formula problem is PSPACE-complete. L, NL and NLcompleteness.NL=coNL. Hierarchy theorems.	8
V	Randomized Complexity: The classes BPP, RP, ZPP.Interactive proof systems: IP = PSPACE.	6
VI	Optimization and approximation: Combinatorial optimization problems. Relative error. Bin-packing problem. Polynomial and fully polynomial approximation schemes. Vertex cover, traveling salesman problem, minimum partition.	7
	TOTAL HOURS	42

TEXT/REFERENCE BOOKS:

T/	BOOK TITLE/AUTHORS/PUBLICATION

R	
T1	Michael Sipser, Introduction to the Theory of Computation, (First edition - PWS Publishing Company, January 1997, or second edition - Thomson Course Technology, 2005).
T2	Sanjeev Arora and Boaz Barak, Computational Complexity: A Modern Approach, Cambridge University Press,2009
R1	Christos H Papadimitriou, Computational Complexity, Addison-Wesley, 1994.
R2	M R Garey and D S Johnson, Computers and Intractability: A Guide to the Theory of NPCompleteness, Freeman, 1979.
R3	Oded Goldreich, Computational Complexity, Cambridge University press, 2008.
R4	Vijay Vazirani, Approximation Algorithms, Springer--Verlag, 2001

COURSE OBJECTIVES:

1	To introduce the fundamentals of computational complexity theory.
2	To discuss basic concepts such as computational models, computational complexity measures (e.g., time and space complexity measures), complexity classes, reducibility and completeness notions.
3	To familiarize the concepts of randomized and approximation algorithms and discuss the related complexity classes.

COURSE OUTCOMES:

SNO	DESCRIPTION	Bloom's Taxonomy Level
469.1	The students will able to determine whether a problem is computable, and prove that some problems are not computable.	Determine(Level 3)
469.2	The students will able to categorize problems into appropriate complexity classes	Categorize(Level 4)
469.3	The students will able to classify problems based on their computational complexity using reductions	Classify(Level 2)
469.4	The students will able to analyze optimization problems using the concept of interactive proofs	Analyze(Level 4)
469.5	The students will able to classify optimization problems into appropriate approximation complexity classes	Classify(Level 2)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PSO 1	PS O2	PSO3
CS469.1	2	2	2	3	-	-	-	-	-	-	-	-	1	1	1
CS469.2	1	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CS469.3	1	2	2	2	-	-	-	-	-	-	-	-	2	2	2

CS469.4	2	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CS469.5	2	2	2	2	-	-	-	-	-	-	-	-	2	2	2
	1.6	2	2	2.2									1.8	1.8	1.8

LOW/MEDIUM/HIGH→1/2/3

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	LOW/MEDIUM/ HIGH	Justification
CS469.1-PO1	M	By applying basic knowledge from mathematics students can develop new solutions to problems.
CS469.1-PO2	M	Students can analyze the complexity of different algorithms
CS469.1-PO3	M	Can design solutions for complex problems with efficient computation time.
CS469.1-PO4	H	Can design better algorithms with better computation speed hence leads to research
CS469.1-PSO1	L	Complex problems can be investigated to get the feasibility study.
CS469.1-PSO2	L	Help to find new solutions.
CS469.2/3-PO1	L	Students can use basic knowledge to classify the problems.
CS469.2/3-PO2	M	Can check the feasibility of new problems in term of other.
CS469.2/3-PO3	M	Classification can help to find global solutions.
CS469.2/3-PSO1	M	Basic ideas help to make reductions between problems.
CS469.2/3-PSO2	M	Using basic principles students can transform the algorithms.
CS469.2/3-PSO3	M	With the concept of reduction students can solve problems in terms of other.
CS469.4/5-PO1	M	Interactive proofs to optimization problems can be designed with basic mathematic knowledge.
CS469.4/5-PO2	M	Classification methods help to analyze the optimization problems very easily.
CS469.4/5-PO3	M	Design better solutions to optimization problems.
CS469.4/5-PO4	M	Complex problems can be solved with optimization methods.
CS469.4/5-PSO1	M	Classification methods help to analyze the optimization problems very easily.
CS469.4/5-PSO2	M	Design better solutions to optimization problems.
CS469.4/5-PSO3	M	Complex problems can be solved with optimization methods.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

S. NO	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Boolean Circuits	Assignment	2,3,4

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

S. NO	TOPIC	PO MAPPING

1	Quantum Computation	2,3

WEB SOURCE REFERENCES:

1	www.nptel.ac.in/courses/105108127/pdf/Module_1/M1L4slides.pdf
2	https://www.springer.com/cda/content/document/cda.../9783642378454-c2.pdf?...
3	https://mech.iitm.ac.in/nspch52.pdf

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	
☐ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☐ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☑ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by

Seema Safar

Approved by

Dr. Dhanya P.M.
(HOD)

CS431 Compiler Design Lab

COURSE INFORMATION SHEET

PROGRAMME: **Computer Science And Engineering**	DEGREE: **BTECH**
COURSE: **COMPILER DESIGN LAB**	SEMESTER**:** **7** CREDITS: **1**
COURSE CODE: **CS431** REGULATION:**2016**	COURSE TYPE: **CORE –LAB**
COURSE AREA/DOMAIN: **System Software Concepts**	CONTACT HOURS: **3** (lab) hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY):**NA**	LAB COURSE NAME: **NA**

SYLLABUS:

1. Design and implement a lexical analyzer for given language using C and the lexical analyzer should ignore redundant spaces, tabs and new lines.
2. Implementation of Lexical Analyzer using Lex Tool
3. Generate YACC specification for a few syntactic categories.

a) Program to recognize a valid arithmetic expression that uses operator +, – , * and /.

b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.

c) Implementation of Calculator using LEX and YACC

d) Convert the BNF rules into YACC form and write code to generate abstract syntax tree

4. Write program to find ε – closure of all states of any given NFA with ε transition.
5. Write program to convert NFA with ε transition to NFA without ε transition.
6. Write program to convert NFA to DFA
7. Write program to minimize any given DFA.
8. Develop an operator precedence parser for a given language.
9. Write program to find Simulate First and Follow of any given grammar.
10. Construct a recursive descent parser for an expression.
11. Construct a Shift Reduce Parser for a given language.
12. Write a program to perform loop unrolling.
13. Write a program to perform constant propagation.
14. Implement Intermediate code generation for simple expressions.
15. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using an 8086 assembler. The target

assembly instructions can be simple move, add, sub, jump etc.

LAB CYCLE

EXPERIMENTS	RS
1. Design and implement a lexical analyzer for given language using C and the lexical analyzer should ignore redundant spaces, tabs and new lines.	3
2. Write program to design recursive descent parser.	3
3. Write program to implement LL (1) parser.	3
4. Write a program to simulate FIRST of any given grammar.	3
5. Write program to implementation of Operator precedence parsing.	3
6. Write program to design of lexical analyzer to check whether the given string is valid according to the regular definition 0 (10 | 01) * using LEX.	3
7. Write lexical analyzer program to list the identifiers from a given C program using LEX.	3
8. Write program to design parser for arithmetic expressions using YACC i) Write a program to check the syntax of switch statement in C. ii) Program to recognize a valid arithmetic expression that uses operator +, – , * and /. iii) Write a program to implement arithmetic calculator.	3
9. Write a program to perform constant propagation.	3
10. Write program to generate Intermediate Code for arithmetic expressions.	3
11. Write program to design a code generator for arithmetic expressions.	3
12. Write program to find ε – closure of all states of any given NFA with ε transition.	3
	36 hrs

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
R1	Aho A Ravi Sethi and J D Ullman, Compilers Principles Techniques and Tools, Addison Wesley
R2	Kenneth C Louden, "Compiler Construction Principles and Practice", Cenage Learning Indian Edition
R3	D M Dhamdhare, System programming and operating system, Tata McGraw Hill & Company
R4	Tremblay and Sorenson, The Theory and Practice of Compiler Writing - Tata McGraw Hill & Company

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
CS305	Compiler Design	Knowledge of Compiler Design	6
CS331	System Software	Knowledge of system software	5

COURSE OBJECTIVES:

1	To implement the different Phases of compiler..
2	To implement and test simple optimization techniques.
3	To give exposure to compiler writing tools.

COURSE OUTCOMES:

SNO	DESCRIPTION	LEVEL
431.1	Students will able to **implement** the techniques of Lexical Analysis and Syntax Analysis.	3
431.2	Students will able to **apply** the knowledge of Lex & Yacc tools to develop programs..	3
431.3	Students will be able to **generate** intermediate code	3
431.4	Students will be able to **implement** Optimization techniques and generate machine level code.	3

CO-PO MAPPING AND CO-PSO MAPPING

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
431.1	2	-	-	-	2	-	-	-	-	-	-	-	-	3	2
431.2	2	-	-	-	2	-	-	-	-	-	-	-	-	3	2
431.3	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
431.4	2	2	-	-	-	-	-	-	-	-	-	-	-	3	3
CS010431 (Overall attainment)	2	2	-	-	2	-	-	-	-	-	-	-	-	2.75	2.33

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	**Low/Medium/High**	**Justification**
431.1-PSO2	H	Usage of LEX tool helps to understand how to design the lexical analyzer.
431.1- PSO3	M	Programming in C and with LEX tool helps to understand how to design the lexical analyzer.
431.1- PO1	M	They are able to use LEX tool for developing lexical analyzer.
431.1- PO2	M	They are able to use LEX tool for developing lexical analyzer.
431.1-PO1	M	Programming in LEX helps to understand basic principles of lexical analysis.
431.1- PO5	M	They are able to use LEX tool for developing lexical analyzer.
431.2- PO5	M	They are able to use YACC tool for developing syntax analyzer.
431.2-PSO2	H	Usage of YACC tool helps to understand how to design the syntax analyzer.
431.2- PSO3	M	Programming in C and with YACC tool helps to understand how to

		design the syntax analyzer.
431.2-PO1	M	Programming in YACC helps to understand basic parsing principles.
431.3-PSO2	M	Knowledge of various intermediate representations helps to generate memory efficient code.
431.3-PO1	M	Knowledge of various intermediate representations helps to generate efficient target code.
431.3-PO2	M	Selection of suitable intermediate representation helps to reduce register usage.
431.4-PSO2	H	Understanding the basic steps of an assembler helps to design a 2 pass assembler.
431.4- PSO3	H	Knowledge about the structure of symbol table helps to develop efficient assemblers.
431.4-PO1	M	Studies about various assemblers helps to distinguish its features and helps to design a two pass assembler
431.4-PO2	M	Knowledge about the design of an assembler helps to understand the structure of symbol table.

GAPS IN THE SYLLABUS TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Design of cross compilers, incremental compilers	Assignments/Miniproject/main project	**a,b,d,e**

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Sl no	DESCRIPTION	PO MAPPING
1	Design of Interpreter	**a,b,d,e**
2	Design of Optimized Compiler	**a,b,d,e**

WEB SOURCE REFERENCES:

1	http://compilers.iecc.com/crenshaw/
2	http://www.cs.utexas.edu/~novak/lexpaper.htm
3	www.cs.rug.nl/~jjan/vb/**yacc**tut.pdf

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

• ☐ CHALK & TALK	• ☐ STUD. ASSIGNMENT	• ☐ WEB RESOURCES	
☐ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☐ ASSIGNMENTS	☐ STUD. SEMINARS	• ☐ TESTS/MODEL EXAMS	• ☐ UNIV. EXAMINATION
• ☐ STUD. LAB PRACTICES	• ☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

・☐ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	・☐ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by

Ms. Mehbooba P Shareef

Ms. Anu Maria Joykutty
Ms. Dincy Paul

Approved by

Dr. Dhanya P M

HOD-CSE

CS451 Seminar & Project Preliminary

COURSE INFORMATION SHEET

PROGRAMME: COMPUTER SCIENCE & ENGINEERING	DEGREE: BTECH
COURSE: SEMINAR AND PROJECT PRELIMINARY	SEMESTER: VII CREDITS: 2
COURSE CODE: CS451 REGULATION: 2015	COURSE TYPE: CORE
COURSE AREA/DOMAIN: Software Design	CONTACT HOURS: 4 hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME:

SYLLABUS:

UNIT	DETAILS	HOURS
	Seminar: Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned, collect sufficient literature on the topic, study it thoroughly, prepare own report and present in the class. Project preliminary: Identify suitable project relevant to the branch of study. Form project team (not exceeding four students). The students can do the project individually also. Identify a project supervisor. Present the project proposal before the assessment board (excluding the external expert) and get it approved by the board. The preliminary work to be completed: (1) Literature survey (2) Formulation of objectives (3) Formulation of hypothesis/design/methodology (4) Formulation of work plan (5) Seeking funds (6) Preparation of preliminary report. The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum **seven latest international journal** papers having high impact factor. Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes. The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 3 faculty members. Apportioning of the marks towards various aspects of seminar	

	(extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee. The student's internal marks for project will be also out of 50. The project can consist of maximum of 4 members. The marks will be awarded based on two presentations i.e., a preliminary project presentation and a design presentation. A bonafide report on seminar and project shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.	
	TOTAL HOURS	2

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
	Seven latest international journal papers having high impact factor

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
All subjects till S7 Computer Science and Engineering.			S1 to s6

COURSE OBJECTIVES:

1	To develop skills in doing literature survey, technical presentation and report preparation.
2	To enable project identification and execution of preliminary works on final semester project

COURSE OUTCOMES:

SNO	DESCRIPTION
1	Analyze a current topic of professional interest and present it before an audience
2	Identify an engineering problem, analyze it and propose a work plan to solve it.

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS451.1		1		2						2					
CS451 .2		2			2								2		
CS451		1.5		2	2					2			2		

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
CS451.1 -P02	L	Students do a literature survey while preparing for the seminar and project
CS451.1 -PO4	M	They reach valid conclusions after the literature survey
CS451.1- PO10	M	Seminar presentations help them to develop public speaking skills
CS451.2-PO4	H	They do detailed research in their area of interest which help them to analyze and synthesis data.
CS451.2-PO5	M	They understand the limitations of the existing techniques and can use the engineering techniques to arrive at valid conclusions
CS451.2-PO10	H	Writing seminar report help them to develop technical report writing skills.
CS451.2-PSO1	M	By comparing different techniques, they can identify, analyze and design complex engineering problems.

WEB SOURCE REFERENCES:

1	ieee.org
2	dl.acm.org
3	Elsevier
4	Springer

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ CHALK & TALK	STUD. ASSIGNMENT	✓ WEB RESOURCES	
☐ LCD/SMART BOARDS	✓ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☐ ASSIGNMENT	**m.** STUD. SEMINA	☐TESTS/MODEL EXAMS	☐ UNIV. EXAMINATION

S	RS		
☐ STUD. LAB PRACTICES	**n.** STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by ,
Dr. Jisha G.,
Ms. Jincy J Fernandez,
Mr. Sandy Joseph

Approved by

Dr. Dhanya P. M.
(HOD)