Year: 2024 - 25

Semester: 6

1. Name of the Faculty : Manojeet Roy — Course Code: CSEG 3015
2. Course : Compiler Design — L: 3
3. Program : B.Tech- CSE — T: 0
4. Target : Level- 1 — P: 0
   C: 3

COURSE PLAN

Target	50% (marks)
Level-1	40% (population)
Level-2	50% (population)
Level-3	60% (population)

1. Method of Evaluation

UG	PG
Quizzes/Tests, Assignments (30%)	Quizzes/Tests, Assignments, seminar (50%)
Mid Examination (20%)	End semester (50%)
End examination (50%)	

2. Passing Criteria

Scale	PG	UG
Out of 10 point scale	SGPA – "6.00" in each semester CGPA – "6.00" Min. Individual Course Grade – "C" Course Grade Point – "4.0"	SGPA – "5.0" in each semester CGPA – "5.0" Min. Individual Course Grade – "C" Course Grade Point – "4.0"

*for PG, passing marks are 40/100 in a paper
*for UG, passing marks are 35/100 in a paper

3. **Pre-requisites:** Data structures, knowledge of automata theory, basic knowledge of computer architecture

4. Course Objectives:

- To introduce the major concept areas of language translation and compiler design.
- To enrich the knowledge in various phases of compiler and its use, code optimization techniques, machine code generation, and use of symbol table.
- To extend the knowledge of parser by parsing LL parser and LR parser.
- To provide practical programming skills necessary for constructing a compiler.

5. **Pedagogy**
   - Presentation
   - Class Test
   - Quizzes
   - Voice over Presentation & Video lectures
   - Performance Tests

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- Concept diary (needs to be maintained by students-short and concise notes that include course concepts that he/she has understood)

6. References:

Text Books	● Abraham Silberschatz, Peter B. Galvin, and Greg Gagne. 2018. Operating System Concepts (10th. ed.). Wiley Publishing. ● Robin Hunter, "The essence of Compiler", 2nd Edition, Pearson Publication
Web resources	
Journals	
Reference books	● Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002. ● Steven S. Muchnick, "Advanced Compiler Design and Implementation, "Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003. ● Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004. ● Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008. .

GUIDELINES TO STUDY THE SUBJECT

Instructions to Students:

1. Go through the 'Syllabus' uploaded on the My UPES-LMS platform in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at Lecture Notes section. These are our lecture notes. Make sure you use them during this course.
4. Check your LMS student portal regularly.
5. Go through study material.
6. Check mails and announcements on LMS student portal.
7. Keep updated with the posts, assignments and examinations which shall be conducted on the LMS student portal.
8. Be regular, so that you do not suffer in any way.

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9. **Cell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices are not permitted in classes during the Tests. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.

This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail to your concerned faculty. Please use an appropriate subject line to indicate your message details.

RELATED OUTCOMES

1. The expected outcomes of the Program:

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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PO9	Individual and team-work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at-large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

2. The expected outcomes of the Specific Program:

PSO1	Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques.
PSO2	Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.
PSO3	

3. The expected outcomes of the Course:

On completion of this course, the students will be able to,

CO 1	Comprehend different phases of compiler.
CO 2	Use concepts of regular grammar to build lexical analyzer.
CO 3	Build parsers for a context free grammar.
CO 4	Synthesize syntax directed translations rules.
CO 5	Assess code and memory optimization techniques to improve the performance of a program.

4. Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes	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

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Course Outcomes														
CO 1	2	2	3			1						2		
CO 2	2	2	3			1						2		
CO 3	2	2	3			1						2		
CO 4	2	2	3			1						2		
CO 5	2	2	3			1						2		
Average	2	2	3			1						2		

5. Course outcomes assessment plan:

components / Course Outcomes	**Quiz**	**Class Test**	**Project/Assignment**	**Mid Semester Examination**	**End Semester Examination**
CO 1	☑	☑	☑	☑	☑
CO 2	☑	☑	☑	☑	☑
CO 3	☑	☑	☑	☐	☑
CO 4	☑	☑	☑	☐	☑
CO 5	☑	☑	☑	☐	☑

BROAD PLAN OF COURSE COVERAGE

Course Activities:

Unit	Description	Planned			Tentative Assessment
		From	To	No. of Sessions	

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Semester: 6

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1.	Introduction to Compiler Design			9	Quiz#1
2.	Basic Parsing Techniques			10	Class Test #1 & Assignment#1
3.	Syntax-Directed Translation			10	Quiz #2
4.	Symbol Table			5	
5.	Introduction to Code Optimization			6	Class Test#2, Assignment #2, and Project

Sessions: Total No. of Instructional periods available for the course: 40

SESSION PLAN

UNIT-I

Lecture No.	Topics to be Covered	CO Mapped
1	Introduction to the course, objectives and outcomes	
2	Compiler- Phases and Passes	CO1

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Semester: 6

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3	Bootstrapping	CO1
4	Finite State Machines and Regular Expressions (A Review)	CO2
5	Application of Regular Expression in Lexical Analysis and Implementation of Lexical Analyzers	CO2
6	Problems using Lex Tool	CO2
7	Formal Grammars and their Applications to Syntax Analysis, BNF Notation, and Ambiguity	CO3
8	The Syntactic Specification of Programming Languages: Context Free Grammars, Derivation and Parse Tree, Capabilities of CFG.	CO3
9	Introduction to YACC	CO3

SESSION PLAN

UNIT-II

Year: 2024 - 25

Semester: 6

1. Name of the Faculty : Manojeet Roy — Course Code: CSEG 3015
2. Course : Compiler Design — L: 3
3. Program : B.Tech- CSE — T: 0
4. Target : Level- 1 — P: 0
   C: 3

Lecture No.	Topics to be Covered	CO Mapped
10	Introduction to the parser and Shift Reduce Parse	CO3
11	Operator Precedence Parsing	CO3
12	Predictive Parsing	CO3
13	LR Parser- The Canonical Collection of LR(0) items	CO3
14	Constructing SLR Parsing Tables	CO3
15	Constructing Canonical LR Parsing Tables,	CO3
16	Constructing LALR Parsing Tables	CO3
17	Ambiguous Grammars	CO3

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18	Implementation of LR Parsing Tables	CO3
19	Constructing LALR set of items and Implementing LALR parser	CO3

SESSION PLAN

UNIT-III

Lecture No.	Topics to be Covered	CO Mapped
20	Syntax Directed Translation Schemes	CO4
21	Implementation of Syntax Directed Translators	CO4
22	Postfix Notation, Parse Tree & Syntax Tree	CO4

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Semester: 6

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23	Three Address Code- Quadruples & Triples	CO4
24	Problems on Three Address Codes	CO4
25	Translation of Assignment Statements, Boolean Expressions	CO4
26	Statements that alters the Flow of Control	CO4
27	Postfix Translation, Translation with a Top Down Parser	CO4
28	More about Translation: Array Reference in Arithmetic Expressions	CO4
29	More about Translation: Procedure Calls, Declaration, and Case Statements	CO4

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Semester: 6

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4. Target : Level- 1 — P: 0
   C: 3

SESSION PLAN

UNIT-IV

Lecture No.	Topics to be Covered	CO Mapped
30	Data Structures for Symbol Tables	CO2/CO3/ CO4
31	Data Structures for Symbol Tables (contd...)	CO2/CO3/ CO4
32	Run Time Administration: Implementation of Simple Stack Allocation Scheme	CO2/CO3/ CO4
33	Storage Allocation in Block Structures Language	CO2/CO3/ CO4
34	Error Detection and Recovery	CO2/CO3/ CO4
35	Error Detection and Recovery (contd...)	CO2/CO3/ CO4

Year: 2024 - 25

Semester: 6

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3. Program : B.Tech- CSE — T: 0
4. Target : Level- 1 — P: 0
   C: 3

SESSION PLAN

UNIT-V

Lecture No.	Topics to be Covered	CO Mapped
36	Loop Optimization	CO5
37	Basic Block and Their DAG Representation	CO5

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Semester: 6

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4. Target : Level- 1 — P: 0
   C: 3

38	Basic Block and Their DAG Representation (contd...)	CO5
39	Value Number and Algebraic Laws	CO5
40	Global Data-Flow Analysis	CO5

Sample format for Indirect Assessment of Course outcomes

NAME:
ENROLLMENT NO:
SAP ID:
COURSE:
PROGRAM:

Please rate the following aspects of course outcomes of Compiler Design. Use the scale 1-4*

S. No.	Course Outcomes	1	2	3	4
1	CO1. Comprehend the different phases of Compiler				
2	CO2. Use concepts of regular grammar to build lexical analyzer				

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Semester: 6

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   C: 3

3	CO3. Build parsers for a context free grammar.				
4	CO4. Synthesize syntax directed translations rules.				
5	CO5.Assess code and memory optimization techniques to improve the performance of a program.				

* 1 Below Average 2 Average 3 Good 4 Very Good