GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3160715
SYSTEM SOFTWARE
6th SEMESTER

Type of course: Elective

Prerequisite: Data Structures, Operating Systems, Microprocessor & Interfacing

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Overview of System Software** Introduction, Software, Software Hierarchy, Systems Programming, Machine Structure, Interfaces, Address Space, Computer Languages, Tools, Life Cycle of a Source Program, Different Views on the Meaning of a Program, System Software Development, Recent Trends in Software Development, Levels of System Software	04	10%
2	**Overview of Language Processors** Programming Languages and Language Processors, Language Processing Activities, Program Execution, Fundamental of Language Processing, Symbol Tables Data Structures for Language Processing: Search Data structures, Allocation Data Structures.	04	10%
3	**Assemblers** Elements of Assembly Language Programming, Design of the Assembler, Assembler Design Criteria, Types of Assemblers, Two-Pass Assemblers, One-Pass Assemblers, Single pass Assembler for Intel x86 , Algorithm of Single Pass Assembler, Multi-Pass Assemblers, Advanced Assembly Process, Variants of Assemblers Design of two pass assembler,	05	15%
4	**Macro and Macro Processors** Introduction, Macro Definition and Call, Macro Expansion, Nested Macro Calls, Advanced Macro Facilities, Design Of a Macro Pre-processor, Design of a Macro Assembler, Functions of a Macro Processor, Basic Tasks of a Macro Processor, Design Issues of Macro Processors, Features, Macro Processor Design Options, Two-Pass Macro Processors, One-Pass Macro Processors	07	20%
5	**Linkers and Loaders**	06	20%

	Introduction, Relocation of Linking Concept, Design of a Linker, Self-Relocating Programs, Linking in MSDOS, Linking of Overlay Structured Programs, Dynamic Linking, Loaders, Different Loading Schemes, Sequential and Direct Loaders, Compile-and-Go Loaders, General Loader Schemes, Absolute Loaders, Relocating Loaders, Practical Relocating Loaders, Linking Loaders, Relocating Linking Loaders, Linkers v/s Loaders		
6	**Scanning and Parsing** Programming Language Grammars, Classification of Grammar, Ambiguity in Grammatic Specification, Scanning, Parsing, Top Down Parsing, Bottom up Parsing, Language Processor Development Tools, LEX, YACC	04	10%
7	**Compilers** Causes of Large Semantic Gap, Binding and Binding Times, Data Structure used in Compiling, Scope Rules, Memory Allocation, Compilation of Expression, Compilation of Control Structure, Code Optimization	03	8%
8	**Interpreters & Debuggers** Benefits of Interpretation, Overview of Interpretation, The Java Language Environment, Java Virtual Machine, Types of Errors, Debugging Procedures, Classification of Debuggers, Dynamic/Interactive Debugger	03	7%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	30	33	-	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1) System Programming by D M Dhamdhere, McGraw Hill Publication
2) System Programming by Srimanta Pal, OXFORD Publication
3) System Programming and Compiler Construction by R.K. Maurya & A. Godbole.
4) System Software – An Introduction to Systems Programming by Leland L. Beck, 3rd Edition, Pearson Education Asia, 2000
5) System Software by Santanu Chattopadhyay, Prentice-Hall India,2007

Course Outcome:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain and classify different methodologies, concepts and approaches to System Software Programming.	15%
CO-2	Identify elements of language processors with various data structures used in development of one-pass and multi-pass assemblers.	25%
CO-3	Examine macro processor, its usage and compare various loading and linking schemes.	25%
CO-4	Build various system programs using language processor development tools such as YACC and Lex.	15%
CO-5	Design code optimization based solution for the given system problems by applying various techniques of compiler, interpreter and debugger.	20%

List of Experiments and Design based Problems (DP)/Open Ended Problem:

(Pl. Note: List of Experiments should be as per theory covered in the class, below mentioned practical are just for the reference purpose)

1. Write a program to implement the lexical analyzer.
2. Write a Lexical Analyzer (using lex utility for UNIX).
3. Write a program to left factor the given grammar.
4. Write a program to remove the Left Recursion from a given grammar.
5. Aim: Implement Recursive Descendent Parsing for the given Grammar.
   E -> T + E / T
   T -> F * T / F
   F -> (E) / i
6. Implement Predictive Parser for the given grammar.
   E -> T + E / T
   T -> F * T / F
   F -> (E) / i
7. Write a SAL program in text file and generate SYMTAB and LITTAB
8. Use macro features of C language
9. Write a program which generates Quadruple Table for the given postfix String
10. Write a C program to parse a given string using Predictive parsing for given grammar.
    type → simple | ↑id | array [simple] of type
    simple → integer | char | num dotdot num

List of Open Source Software/learning website:

- www.cs.jhu.edu/~scott/pl/lectures/parsing.html
- www.en.wikipedia.org/wiki/System_programming
- https://www.isi.edu/~pedro/Teaching/CSCI565-Fall15/Materials/LexAndYaccTutorial.pdf
- https://developer.ibm.com/technologies/systems/tutorials/au-lexyacc/

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