



## NARSIMHA REDDY ENGINEERING COLLEGE

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### FORMAL LANGUAGES AND AUTOMATA THEORY (23CY503)

#### UNIT V – Undecidability and Advanced Turing Machines

##### Part-A: Short Answer Questions

1. Define Recursive Language.
2. Define Recursively Enumerable Language.
3. What is the Halting Problem?
4. Define Undecidability.
5. What is Post Correspondence Problem (PCP)?
6. Define Modified PCP.
7. What is a Counter Machine?
8. Differentiate Recursive and RE Languages.
9. What is a Decidable Problem?
10. Define Turing Recognizer.

##### Part-B: Descriptive Questions

1. Explain the concept of undecidability.
2. Discuss recursive and recursively enumerable languages.
3. Explain the Halting Problem and its significance.
4. Describe Post Correspondence Problem with examples.
5. Discuss undecidable problems related to Turing Machines.
6. Explain counter machines and their computational capabilities.

##### Tutorial Assignment:

Prepare a report explaining why the Halting Problem is undecidable.

##### Part-C: MCQs

1. The Halting Problem was introduced by:

- A) Alan Turing
- B) Chomsky
- C) Greibach
- D) Arden

2. The Halting Problem is:

- A) Undecidable
- B) Decidable
- C) Regular
- D) Context-Free

3. A language accepted by a Turing Machine is:

- A) Recursively Enumerable
- B) Regular
- C) Finite
- D) Context-Free

4. A Recursive Language is always:

- A) Recursively Enumerable ✓
- B) Context-Free
- C) Finite
- D) Ambiguous

5.RE stands for:

- A) Recursively Enumerable ✓
- B) Regular Expression
- C) Recursive Evaluation
- D) Regular Enumeration

6.A problem is undecidable if:

- A) No algorithm solves all instances ✓
- B) It has finite states
- C) It is regular
- D) It is context-free

7.PCP stands for:

- A) Post Correspondence Problem ✓
- B) Program Control Problem
- C) Pushdown Control Problem
- D) Parsing Control Problem

8.PCP was proposed by:

- A) Emil Post ✓
- B) Alan Turing
- C) Chomsky
- D) Kleene

9.Modified PCP is abbreviated as:

- A) MPCP ✓
- B) PPCP
- C) DPCP
- D) CPCP

10.The PCP is:

- A) Undecidable ✓
- B) Decidable
- C) Recursive
- D) Regular

11.A Universal Turing Machine can:

- A) Simulate other Turing Machines ✓
- B) Accept only regular languages
- C) Replace PDA
- D) None

12.Recursive Languages are:

- A) Decidable ✓
- B) Undecidable
- C) Ambiguous
- D) Infinite

13.Counter Machines use:

- A) Counters ✓
- B) Stack
- C) Queue
- D) Graph

14. The Halting Problem determines:

- A) Whether a TM halts or not ✓
- B) DFA minimization
- C) CFG ambiguity
- D) PDA acceptance

15. Every Recursive Language is:

- A) RE ✓
- B) CFL
- C) Regular
- D) None

16. The complement of a Recursive Language is:

- A) Recursive ✓
- B) RE only
- C) CFL
- D) Regular

17. Undecidable problems cannot be solved by:

- A) Any algorithm ✓
- B) DFA
- C) PDA
- D) CFG

18. The class RE contains:

- A) Recursive Languages ✓
- B) Regular Languages only
- C) CFL only
- D) None

19. A language not accepted by any TM is:

- A) Not Recursively Enumerable ✓
- B) Recursive
- C) Regular
- D) CFL

20. The study of undecidability is part of:

- A) Computability Theory ✓
- B) Networking
- C) Databases
- D) Software Engineering

#### Part-D: Fill in the Blanks

1. The Halting Problem was proposed by \_\_\_\_\_.  
**Answer:** Alan Turing
2. The Halting Problem is an \_\_\_\_\_ problem.  
**Answer:** Undecidable
3. RE stands for \_\_\_\_\_ Enumerable.  
**Answer:** Recursively
4. Recursive Languages are always \_\_\_\_\_.  
**Answer:** Decidable
5. Every Recursive Language is \_\_\_\_\_.  
**Answer:** RE
6. PCP stands for Post \_\_\_\_\_ Problem.  
**Answer:** Correspondence

7. PCP was introduced by Emil \_\_\_\_\_.  
**Answer:** Post
8. Modified PCP is abbreviated as \_\_\_\_\_.  
**Answer:** MPCP
9. A Universal Turing Machine can \_\_\_\_\_ other Turing Machines.  
**Answer:** Simulate
10. A language accepted by a TM is called \_\_\_\_\_ Enumerable.  
**Answer:** Recursively
11. A language not accepted by any TM is not \_\_\_\_\_.  
**Answer:** Recursively Enumerable
12. Counter Machines use \_\_\_\_\_ for storage.  
**Answer:** Counters
13. Recursive Languages are closed under \_\_\_\_\_.  
**Answer:** Complement
14. The Halting Problem asks whether a TM will \_\_\_\_\_.  
**Answer:** Halt
15. Undecidable problems have no general \_\_\_\_\_.  
**Answer:** Algorithm
16. Computability theory studies what can be \_\_\_\_\_.  
**Answer:** Computed
17. Recursive Languages are a subset of \_\_\_\_\_ Languages.  
**Answer:** RE
18. PCP is a famous \_\_\_\_\_ problem.  
**Answer:** Undecidable
19. A Universal Turing Machine is a model of a modern \_\_\_\_\_.  
**Answer:** Computer
20. Turing Machines form the foundation of \_\_\_\_\_ Theory.  
**Answer:** Computability