Gujarat Technological University
BE Electrical, Semester -6

Computer Aided Analysis & Design for Electrical Engineering

(2160911)

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Syllabus

- Chapter -1
  - Concept of Computer-aided Design and Optimization
- Chapter – 2
  - Basic Concepts of Design
- Chapter – 3
  - Application of Finite Element Method in Design
- Chapter-4
  - Computer Aided Design of Electrical Apparatus
- Chapter – 5
  - Computer Aided Design of DC Machines
- Chapter – 6
  - Computer Aided Design of Transformer

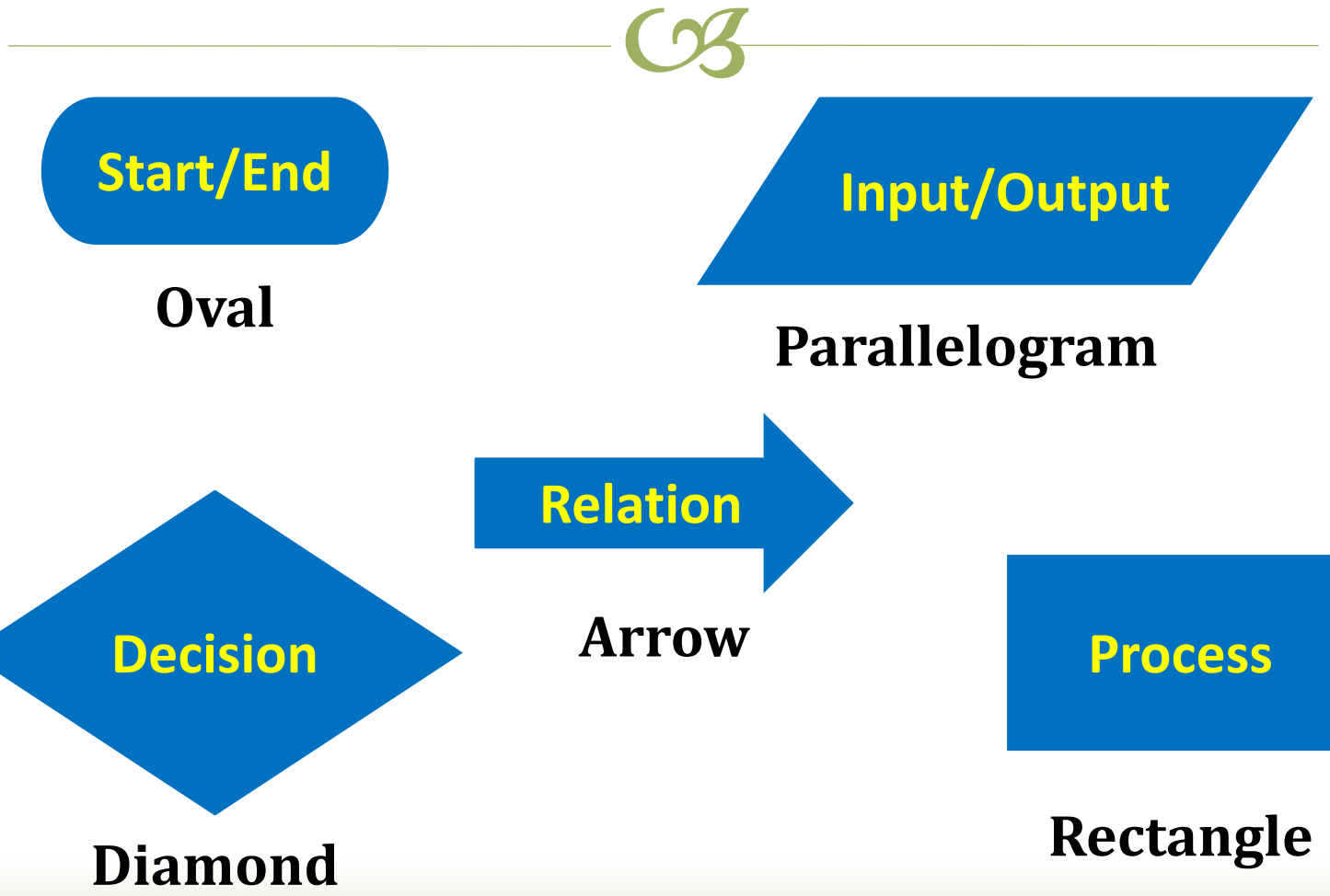
Chapter -1
Concept of Computer-Aided Design and Optimization

What is Deign?
What is Engineering Design?
Major considerations while designing
Flowchart
Input data to fed into program
Constrains (Limitation) in design
Output data to be printed
Optimization

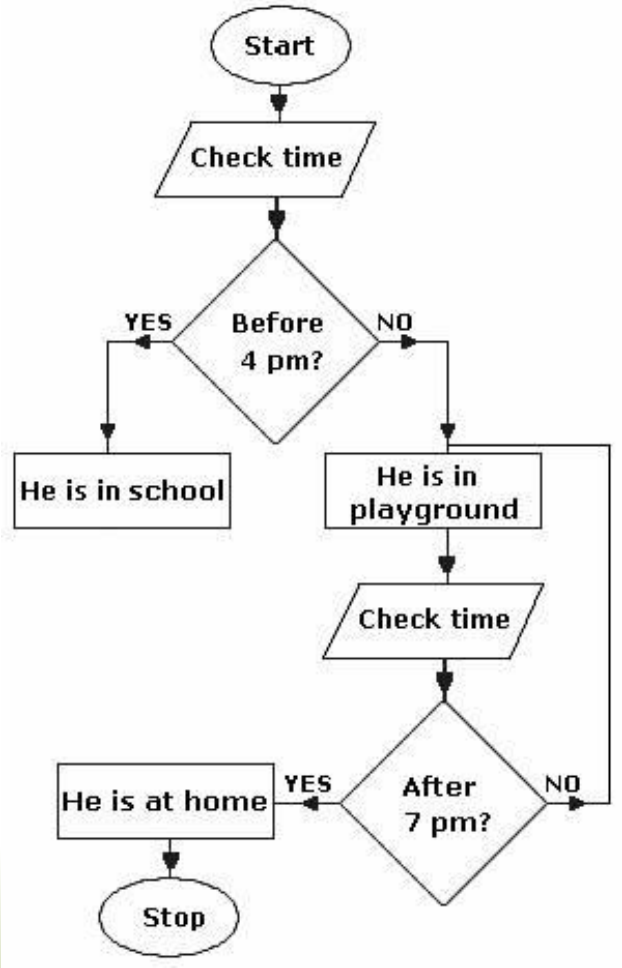
Flowchart

- A flowchart is a visual representation of the sequence of steps and decisions needed to perform a process.
- Each step in the sequence is noted within a diagram shape.
- Steps are linked by connecting lines and directional arrows.
- This allows anyone to view the flowchart and logically follow the process from beginning to end.

Flowchart


Start/End
Oval
Input/Output
Parallelogram
Relation
Arrow
Decision
Diamond
Process
Rectangle

Flowchart


Start
Check time
Before 4 pm?
YES
NO
He is in school
He is in playground
Check time
After 7 pm?
YES
NO
He is at home
Stop

Input Data to be Fed into the Program

- 1. Rating of the machine (KW/KVA)
- 2. Rated Voltage
- 3. Rated Frequency (for AC only)
- 4. Rated Speed (RPM)
- 5. Type of Connection of Phases (Star/Delta) for 3 ph AC
- 6. Type of Winding (Lap/Wave)
- 7. Number of Parallel Paths

Input Data to be Fed into the Program

- 8. Shunt/Compound in case of DC Machine
- 9. Squirrel Cage/Slip Ring type for 3-ph Ind.Motor
- 10. Rated Slip /Rotor speed for Ind.Motor
- 11. Salient Pole/Round rotor type for 3-ph Alternators
- 12. Rated power factor for 3-ph Alternators
- 13. Core/Shell type for Transformers
- 14. Ratings of HV /L V for Transformers

Applicable Constraint Max/Min Permissible Limit

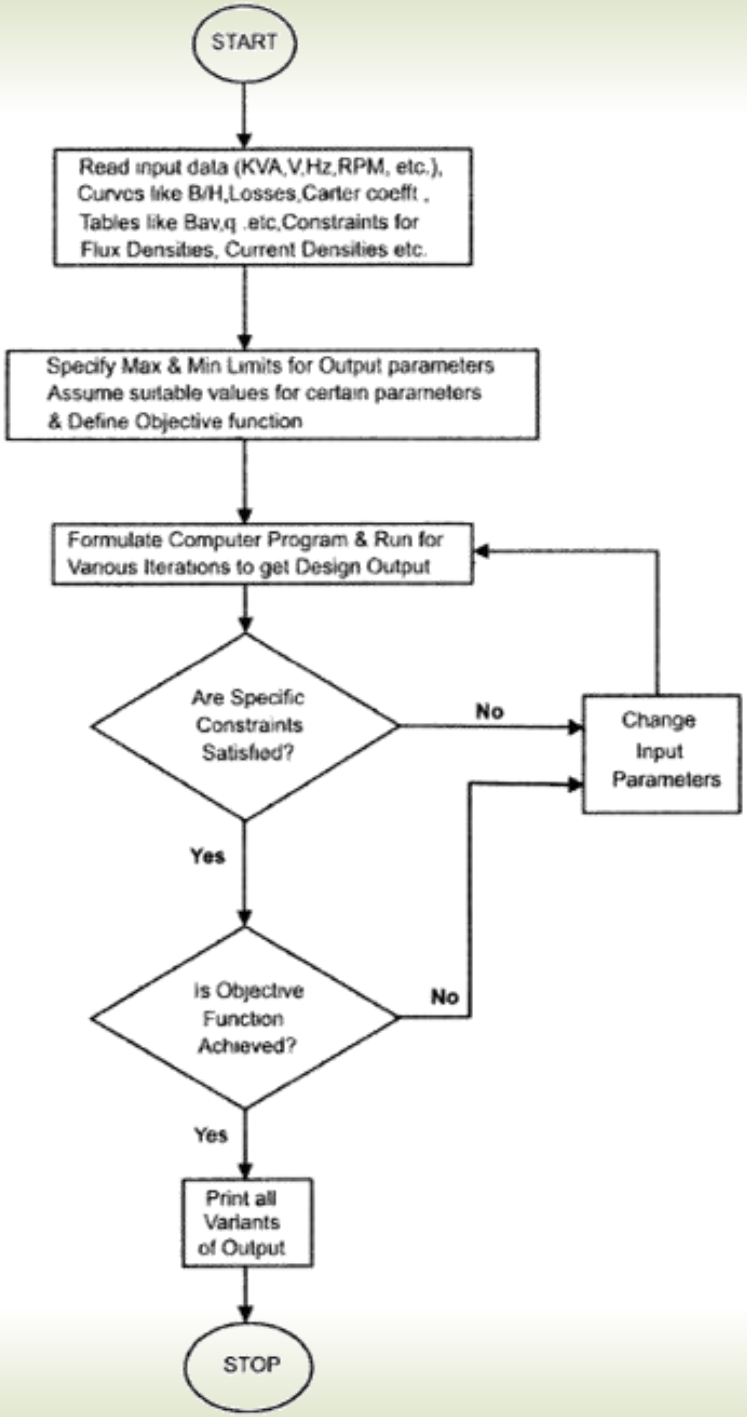
- 1. Flux density in core, tooth, yoke
- 2. Current densities in all windings of the machine
- 3. Ratio of Pole arc to pole pitch
- 4. Ratio of Length to pole arc
- 5. Current Volume per slot of DC armature
- 6. Peripheral velocity of rotor
- 7. Frequency of flux reversal in DC armature

Applicable Constraint
Max/Min Permissible Limit

- 8. Current per Brush arm in DC armature
- 9. Voltage between Commutator segments in armature
- 10. Pole pitch
- 11. Temperature Rises
- 12. Power factor in Ind. Motor
- 13. No load current in Ind. Motor
- 14. Starting Torque in Ind. Motor

Applicable Constraint Max/Min Permissible Limit

- 15. Number of Slots in Armature
- 16. Space motor of the slot in 1-ph Ind. Motor
- 17. Rotor slots in Ind. Motor
- 18. Eddy current loss factor in AC machine
- 29. Short Circuit Ratio of Alternator
- 20. Leakage reactance on AC Machine
- 22. Regulation
- 23. Saturation factor.



Output Data to be Printed after Execution of Program

- 1. Main Dimensions and Internal dimensions of the machine
- 2. No. of slots
- 3. Turns in all windings
- 4. Copper sizes in all windings
- 5. Weights
- 6. Losses

Output Data to be Printed after Execution of Program

- 7. Efficiency
- 8. Reactances
- 9. Full load Field current
- 10. Temperature rise
- 11. No. of cooling tubes for a transformer
- 12. Diameter and number of segments in Commutator
- 13. Full load slip of lnd. Motor.

Output Data to be Printed after Execution of Program

- 1. Open Circuit, Short Circuit and Load magnetization characteristics of Alternator
- 2. Slip vs. Torque curves of Ind.

Various Objective Parameters for Optimization in an Electrical Machine

- (a) Higher Efficiency
- (b) Lower weight for given KVA output (Kg/KVA)
- (c) Lower Temperature-Rise
- (d) Lower Cost
- (e) Any other parameter like higher PF for Induction motor, higher Reactance

Thank You

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