2020

Shivajirao Kadam Institute of Technology & Management, Indore

Department of Computer Science & Engineering

Analysis & Design of Algorithm

[LAB ASSIGNMENT ADA (CS-402)]

To understand the Algorithms as a practical approach. The purpose of this assignment is to cover the underlying concepts and techniques used in Analysis & Design of Algorithm.

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Content

S. No.	Problem Statement	Remark
1	In college library where all the books are sorted alphabetically in the racks. You have to search for a book of algorithm named Coremen. Which method will be best suited for searching. Apply the searching method iteratively and recursively.	
2	A stock market manager has 300 files. He want to sort the files according the names. Some of the files were not properly sorted by time. Each file is about 150 MB, so he could not load all the data into RAM at once. Use external sorting algorithm to sort files because of limited RAM.	
3	You have a shopping list, and your mother is telling you to grab them in 15 minutes. She gives you also priorities, so you need to grab them first. You gotta rush! Eggs (4) Bread (2), Milk (6), Water (3), Meat (1), Detergent (5). For small lists, it is easy to seek through with eyes and follow priority numbers. But think about she give you list of items with count of 128? What you are going to do? Would you check entire list to find next item? So you will be reordering list by priority, by comparing them on first element which is eggs.	
4	You need to find the optimal position for a firehouse in town. You generate a block-by-block fire risk matrix as matrix A and a travel time matrix generated about some fixed point in town as matrix B. Apply Strassen's Matrix Multiplication for finding optimal position.	
5	Apply Huffman coding algorithm for encoding of files.	
6	You want lay cables accross a city or group of cities. Find Minimum Cost Spanning Tree/Path of a given undirected path of cities(graph) using Kruskal's algorithm.	
7	Design a network of pipes for drinking water for small outlying villages. Find Minimum Cost Spanning Tree/ Path of a given undirected path of villages using Prim's algorithm.	
8	To Study single sources shortest path algorithm and its analysis	
9	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using OpenMP and determine the speed-up achieved.	
10	Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.	

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Department of Computer Science and Engineering
Lab Work

Subject: Analysis Design Of Algorithm **Subject Code: CS-402** **Session: Jan-June 2020**
Tools/Language Used: C,C++

S. No.	Title	Objective of the Experiment	Problem Statement	Outcome of the Experiment	Mapping with CO				
					CO1	CO2	CO3	CO4	CO5
1	Iterative and Recursive binary search	To know the how to apply binary search method iteratively and recursively	In college library where all the books are sorted alphabetically in the racks. You have to search for a book of algorithm named Coremen. Which method will be best suited for searching. Apply the searching method iteratively and recursively	Must be known about Iterative and Recursive method	√				
2	Divide and conquer technique method that is Merge Sort	To know the concept of Merge Sort.	A stock market manager has 300 files. He want to sort the files according the names. Some of the files were not properly sorted by time. Each file is about 150 MB, so he could not load all the data into RAM at once. Use external sorting algorithm to sort files because of limited RAM.	Must be known how to sort the element by merge sort	√	√			
3	Divide and conquer technique method that is Quick Sort	To know the concept of Quick Sort.	You have a shopping list, and your mother is telling you to grab them in 15 minutes. She gives you also priorities, so you need to grab them first. You gotta rush! Eggs (4) Bread (2), Milk (6), Water (3), Meat (1), Detergent (5). For small lists, it is easy to seek through with eyes and follow priority numbers. But think about she give you list of items with count of 128? What you are going to do? Would you check entire list to find next item? So you will be reordering list by priority, by comparing them on first element which is eggs.	Must be able to apply quick sort over the list	√	√			
4	Divide and conquer technique	To understand Strassen's Matrix Multiplication	You need to find the optimal position for a firehouse in town. You generate a block-by-block fire risk matrix as matrix A and a travel time matrix generated about some fixed point in town as matrix B. Apply Strassen's Matrix Multiplication for finding optimal position.	Must be solve the numerical of 2*2 matrix Multipication	√	√			
5	Greedy Strategy	To learn Huffman coding.	Apply Huffman coding algorithm for encoding of files.	Identitfied the Algorithm Steps				√	
6	Minimum Spanning tree	To understand Kruskal's algorithm.	You want lay cables accross a city or group of cities. Find Minimum Cost Spanning Tree/Path of a given undirected path of cities(graph) using Kruskal's algorithm.	Must be able to done the numerical then make program			√	√	
7	Minimum Spanning tree	To understand Prim's algorithm.	Design a network of pipes for drinking water for small outlying villages. Find Minimum Cost Spanning Tree/ Path of a given undirected path of villages using Prim's algorithm.	Must be able to done the numerical then make program	√		√	√	

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S. No.	Title	Objective of the Experiment	Problem Statement	Outcome of the Experiment	Mapping with CO				
					CO1	CO2	CO3	CO4	CO5
8	Greedy Strategy	To know single sources shortest path algorithm..	To Study single sources shortest path algorithm and its analysis	Must be able to done the numerical then make program	√			√	
9	Dynamic Programming	To understand Floyd Warshal algorithm	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using OpenMP and determine the speed-up achieved.	Must be able to done the numerical then make program	√				√
10	Dynamic Programming	Tounderstand traveling salesman problem	Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.	Must be able to done the numerical then make program	√				√

Course Outcomes (CO)

C402.1 Learn the basic concepts of Algorithms including designing.
C402.2 To implement problem based on divide and conquer strategy.
C402.3 Solve problems based on Backtracking concepts.
C402.4 Learn Greedy Strategy to solve the problems like optimal merge pattern and knapsack.
C402.5 Learn concepts of Dynamic Programming to solve real life problems.

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Shivajirao Kadam Institute of Technology & Management, Indore Department of Computer Science and Engineering **Experiment-01** **Laboratory Performance Evaluation**	
Academic Session: Jan-June 2020	Semester & Batch: 4 Semester
Name of Lab: Analysis & Design Of Algorithm	Course Code: CS-402
Name of Experiment: In college library where all the books are sorted alphabetically in the racks. You have to search for a book of algorithm named Cormen. Which method will be best suited for searching. Apply the searching method iteratively and recursively	**CO No.** CO1
Group*: *<if any>* Type**:	Periods needed**0*:
Name of Student:	Enrollment No.

Date of Experiment	Date of Submission

Grade and remark by the tutor	Score (0- 10)	Remark / Reason
1. Clarity about the Objective and Outcome of experiment		
2. Submitted the work in desired format		
3. Shown capability to solve the problems		
Average (out of 10)		

1. **Title:-** Iterative & recursive binary Search

2. **Outcome:** Must be known about Iterative and Recursive method

3. **Objectives:** To know the how to apply binary search method iteratively and recursively

4. **Nomenclature, theory with self-assessment questionnaire:**

A binary search, also known as a half-interval search, is an algorithm used in computer science to locate a specified value (key) within an array. For the search to be binary, the array must be sorted

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in either ascending or descending order Given a sorted array arr[] of n elements, write a function to search a given element x in arr[].

Binary search is an efficient algorithm for finding an item from a sorted list of items. It works by repeatedly dividing in half the portion of the list that could contain the item, until you've narrowed down the possible locations to just one

Binary search is the most popular Search algorithm. It is efficient and also one of the most commonly used techniques that is used to solve problems.

If all the names in the world are written down together in order and you want to search for the position of a specific name, binary search will accomplish this in a maximum of 35 iterations.

Binary search works only on a sorted set of elements. To use binary search on a collection, the collection must first be sorted.

When binary search is used to perform operations on a sorted set, the number of iterations can always be reduced on the basis of the value that is being searched.

Let us consider the following array:

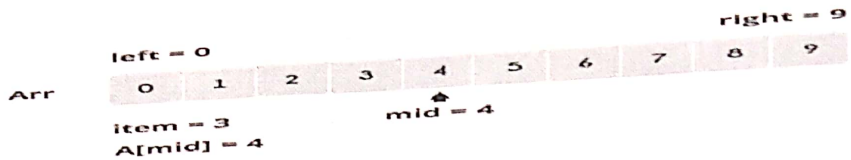
By using linear search, the position of element 8 will be determined in the 9th iteration.

Let's see how the number of iterations can be reduced by using binary search. Before we start the search, we need to know the start and end of the range. Lets call them Low and High.

Low = 0

High = n-1

Now, compare the search value K with the element located at the median of the lower and upper bounds. If the value K is greater, increase the lower bound, else decrease the upper bound.



Referring to the image above, the lower bound is 0 and the upper bound is 9. The median of the lower and upper bounds is (lower_bound + upper_bound) / 2 = 4. Here a[4] = 4. The value 4>2, which is the value that you are searching for. Therefore, we do not need to conduct a search on any element beyond 4 as the elements beyond it will obviously be greater than 2.

Therefore, we can always drop the upper bound of the array to the position of element 4. Now, we follow the same procedure on the same array with the following values:

```
Low:  0
High: 3
```

Repeat this procedure recursively until Low > High. If at any iteration, we get a[mid]=key, we return value of mid. This is the position of key in the array. If key is not present in the array, we return −1.

Implementation:

```
int binarySearch(int low,int high,int key)
{
  while(low<=high)
  {
   int mid=(low+high)/2;
   if(a[mid]<key)
   {
     low=mid+1;
   }
```

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```
    else if(a[mid]>key)
    {
       high=mid-1;
    }
    else
    {
       return mid;
    }
  }
  return -1;              //key not found
}
```

References:

1. Coremen Thomas, Leiserson CE, Rivest RL; Introduction to Algorithms; PHI.
2. Horowitz & Sahani; Analysis & Design of Algorithm
3. Dasgupta; algorithms; TMH

Problem Enunciation: With the help of this practical student-

a. Will be able to understand searching method

b. Will be able to understand how the divide & conquer technique works in order to solve the problem

5. Tutorial Problem:-

You have been given an array A consisting of N integers. All the elements in this array A are unique. You have to answer some queries based on the elements of this array. Each query will consist of a single integer x. You need to print the rank based position of this element in this array considering that the array is *1* indexed. The rank based position of an element in an array is its position in the array when the array has been sorted in ascending order..

6. Experimental setup with list of equipment, components, and expectations

6.1 Hardware & Software Requirement

Minimum Hardware Requirement:

Processor: Pentium 4

RAM: 128MB

HDD Space: 40GB

Minimum Software Requirement:

Turbo C++ IDE (TurboC3)

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7. Quiz & Viva Questions

7.1 Quiz

1.) Binary search algorithm cannot be applied to …
A. **sorted linked list**
B. sorted binary trees
C. sorted linear array
D. pointer array

2.) What is the advantage of recursive approach than an iterative approach?
A. Consumes less memory
B. **Less code and easy to implement**
C. consumes more memory
D. More code has to be written

3.) Given an input arr = {2,5,7,95,899}; key = 899; What is the level of recursion?
A. 5
B. 2
C. **3**
D. 4

4.) What is the average case time complexity of binary search using recursion?
A. O(nlogn)
B. **O(logn)**
C. O(n)
D. $O(n^2)$

5.) Binary Search can be categorized into which of the following?
A. Brute Force technique
B. **Divide and conquer**
C. Greedy algorithm
D. Dynamic programming

7.2 Viva

Q.1 Advantage of Binary Search?

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Q.2 When is binary search used for?

Q.3 What is time complexity of binary search algorithm

To be Done by the Student

8.1 Hardware & Software Used

Minimum Hardware Used:

Processor : Intel Core i3
RAM : 4GB DDR-3
HDD Space: 200 GB

Minimum Software Requirement:

Turbo C++ IDE (TurboC3)
Borland Turbo C++ (Version 4.5)

8. Theoretical solution of the instant problem

```
int main()

{

   int c, first, last, middle, n, search, array[100];

   printf("Enter number of elements:\n");

   scanf("%d",&n);

  printf("Enter %d integers:\n", n);

  for (c = 0; c < n; c++)

     scanf("%d",&array[c]);

 printf("Enter the value to find:\n");

 scanf("%d", &search);

 first = 0;
```

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```
    last = n - 1;
    middle = (first+last)/2;
    while (first <= last) {
       if (array[middle] < search)
          first = middle + 1;
       else if (array[middle] == search) {
          printf("%d is present at index %d.\n", search, middle+1);
          break;
       }
       else
          last = middle - 1;
       middle = (first + last)/2;
    }
    if (first > last)
       printf("Not found! %d is not present in the list.\n", search);
    return 0;
}
```

9. Results

After performing this practical successfully student would learn about binary searching and how it works.

10. Solved Tutorial Problems

1. Advantage of Binary Search?

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1. Compared to linear search (checking each element in the array starting from thefirst), binary search is much faster. Linear search takes, on average N/2 comparisons (where N is the number of elements in the array), and worst case N comparisons. Binary search takes an average and worst-case comparisons.

2. When is binary search used for?

2. In its simplest form, binary search is used to quickly find a value in a sorted sequence (consider a sequence an ordinary array for now). We'll call the sought value the target value for clarity. Binary search maintains a contiguous subsequence of the starting sequence where the target value is surely located.

3. What is time complexity of binary search algorithm

3. Time Complexity of Binary Search Algorithm is $O(\log_2 n)$.Here, n is the number of elements in the sorted linear array. This time complexity of binary search remains unchanged irrespective of the element position even if it is not present in the array.

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New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, III-Semester

ME303 Materials Technology

List of Experiments:

	Metallographic studies – Study of Optical microscope, Optically flat surface preparation, etching reagents, Grain size- ASME no., micro structures, Image analysis, Standard specimen,
	Carbon, sulphur, Phosphorus determination, Strauhlin's apparatus, Eggert's Method in different samples.
	Hardness and Hardenability test, Jeremy Cony test. Soft and hard Martensite.
	Different heat treatment cycles using electric furnace [Programmable preferred], Annealing, Case carburising, Normalising, etc.
	Gravimetric / Volumetric - chemical analysis of alloying elements like, Cr, Ni, Mn, Si etc.
	Study of different instrumental method of analysis, spectrophotometers, Differential Scanning calorimeter.
	Cupping test / formability test for sheet metal
	Spot test for quick assessment of alloying elements like Mn, Cr, Ni, etc

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Mechanical Engineering, III-Semester

ME304 Strength of Material

List of Experiments:

1. Standard tensile test on MS and CI test specimen with the help of UTM.
2. Direct/ cross Shear test on MS and CI specimen.
3. Transverse bending test on wooden beams to obtain modulus of rupture.
4. Fatigue test.
5. Brinell Hardness tests.
6. Vicker hardness test.
7. Izod/Charpy test.
8. Rockwell Hardness test.

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Mechanical Engineering, III-Semester

ME 305 Manufacturing Process

List of Experiments:

1. Study of tools used for various manufacturing processes, study includes application & live demonstration of hand and machine tools.
2. Hands on Exercise on Pattern Making.
3. Performance on Metal Casting of Simple component.
4. Performance on Welding of simple work piece (Example Arc and Resistance Welding).
5. Exercise Problems on Welding
6. Exercise problems on Casting
7. Study of forging machine & demonstration of various operations of forging .
8. Study of Hydraulic, Pneumatic presses & demonstration of piercing, slitting, deep drawing operations on press machine.

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Mechanical Engineering, III-Semester

ME306 Thermal Engg Lab

List of Experiments:

1. To determine volumetric and isothermal efficiencies of a single stage compressor.
2. Study of two stage air compressor with intercooler.
3. To determine volumetric and isothermal efficiencies of a two stage compressor.
4. Study of different types of boilers and their classifications.
5. Study of different types of high pressure boilers.
6. To determine the performance of boiler.
7. Temperature measurements, Pyrometers and thermography.
8. Thermocouples, Temperature sensors, study and calibration.
9. Study and experiments on ORSAT apparatus.
10. Experiments on calorific value of different fuels and analysis of exhaust gases.

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Mechanical Engineering, IV-Semester

ME403 -THEORY OF MACHINES

Tutorials:

1. Displacement diagrams of slider crank and other linkages, analytical and graphical
2. Velocity diagrams and acceleration diagrams
3. Diagrams of cam and followers for different applications
4. Gears and gear trains transmission diagrams, analytical and graphical applications
5. Solutions to problems of industrial application using software

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New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, IV-Semester

ME403 -THEORY OF MACHINES

Tutorials:

1. Displacement diagrams of slider crank and other linkages, analytical and graphical
2. Velocity diagrams and acceleration diagrams
3. Diagrams of cam and followers for different applications
4. Gears and gear trains transmission diagrams, analytical and graphical applications
5. Solutions to problems of industrial application using software

EXPERIMENT No. 1

AIM:-To Perform Experiment On Watt And Porter Governors To Prepare Performance Characteristic Curves, And To Find Stability & Sensitivity.

APPARATUS USED:- Universal Governor Apparatus & Tachometer.

INTRODUCTION & THEORY :- The function of a governor is to regulate the mean speed of an engine, when there are variations in loads e.g. when load on an engine increase or decrease, obviously its speed will, respectively decrease or increase to the extent of variation of load. This variation of speed has to be controlled by the governor, within small limits of mean speed. This necessitates that when the load increase and consequently the speed decreases, the supply of fuel to the engine has to be increased accordingly to compensate for the loss of the speed, so as to bring back the speed to the mean speed. Conversely, when the load decreases and speed increases, the supply of fuel has to be reduced.

The function of the governor is to maintain the speed of an engine within specific limit whenever there is a variation of load. The governor should have its mechanism working in such a way, that the supply of fuel is automatically regulated according to the load requirement for maintaining approximately a constant speed. This is achieved by the principle of centrifugal force. The centrifugal type governors are based on the balancing of centrifugal force on the rotating balls by an equal and opposite radial force, known as the controlling force.

Governors are broadly classified as:

a) Centrifugal Governors.
b) Inertia Governors.

The centrifugal governors are based on the balancing of centrifugal force on the rotating balls by an equal and opposite radial force, known as controlling force.

In Inertia governors the position of the balls are affected by the forces set by an angular acceleration or deceleration of the given spindle in addition to centrifugal forces on the balls.

DESCRIPTION:

The apparatus is designed to exhibit the characteristics of the spring-loaded governor and centrifugal governor. The experiments shall be performed on following centrifugal type governors:

1. Watt governor
2. Porter governor
3. Proell governor
4. Hartnell governor

WATT GOVERNOR

It is the simplest form of a centrifugal governor, which is known as Watt Governor. It is the original form of the governor used by Watt on early steam engines. It consists of two balls which are attached to the spindle with the helps of links or arms. It is basically a conical pendulum with links attached to a sleeve of negligible mass. The arms of the governor may be connected to the spindle in the following three ways :

- The pivot P, may be on the spindle axis.
- The pivot P, may be offset from the spindle axis and the arms when produced intersect at O.
- The pivot P, may be offset, but the arms crosses the axis at O.

Porter Governor :- The porter governor is a modification of a Watt's governor, with central load attached to the sleeve. The load moves up down the central spindle. This additional downward force increases the speed of revolution required to enable the balls to rise to any to any pre-determined level.

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PROCEDURE:

Starting Procedure:

1. Assemble the governor to be tested.
2. Complete the electrical connections.
3. Switch ON the main power.
4. Note down the initial reading of pointer on the scale.
5. Switch On the rotary switch.
6. Slowly increase the speed of governor until the sleeve is lifted from its initial position by rotating Variac.
7. Let the governor be stabilized.
8. Increase the speed of governor in steps to get the different positions of sleeve lift at different RPM.
9. Increase the speed of governor in steps to get the different positions of sleeve lift at different RPM.

Closing Procedure:

1. Decrease the speed of governor gradually by bringing the Variac to zero position and then switch off the motor.
2. Switch OFF all switches.
3. Disconnect all the connections.
4. Draw the graph for governor as stated further in manual.
5. Repeat the experiment for different type of governor.

PRECAUTIONS :-

1. Take reading carefully.
2. Measure the angle very carefully.
3. Measure the height of governor carefully.
4. Speed of governor measure accurate.

OBSERVATION :-

- Mass of the ball (m) = ----------kg.
- Weight of the ball (w)=----------Newtons
- Height of the governor (h) = ------- metres
- Minimum equilibrium speed (N_1) = ------ r.p.m.
- Minimum equilibrium speed (N_2) = ------ r.p.m.
- Frictional force (F) = ---------- Newtons
- Mean equilibrium speed (N) = (N_1 + N_2)/2 in r.p.m
- Mass of the central load = ---------kg.
- Weight of the central load (W) = --------N
- Angle of inclination of the arm to the vertical (α) = ------
- Angle of inclination of the link to the vertical (β) =----------

OBSERVATION TABLE:

Initial reading of pointer on scale, X' = mm

Selected ball weight, w = kg

S. No.	Sleeve displacement, X" mm	Speed, N_{act} RPM

Plot the graph for following curves: -

1. Sleeve (X) vs. N_{tho}
2. Sleeve (X) vs $N_{act.}$

CALCULATION :-

- $N^2 = 895/h$ (For watt governor)
- $N^2 = \frac{m + M(1+q)/2}{m} \times 895/h$ (For porter governor), where, $q = \tan\beta / \tan\alpha$
- Sensitiveness of the governor $= 2(N_1 - N_2)/ N_1 + N_2 = 2(\omega_2 - \omega_1)/ \omega_2 + \omega_1$
- A governor is said to be stable when for every speed within the working range there is a definite configuration i.e; there is only one radius of rotation of the governor balls at which the governor is in equilibrium. For a stable governor, if the equilibrium speed increases, the radius of governor balls must also increase.

RESULT :-

- Sensitiveness of the governor is = ----------

EXPERIMENT No. 2

AIM :-To Perform Experiment On Proell Governor To Prepare Performance Characteristic Curves, And To Find Stability & Sensitivity.

APPARATUS USED:- Universal Governor Apparatus & Tachometer.

INTRODUCTION & THEORY :- The function of a governor is to regulate the mean speed of an engine, when there are variations in loads e.g. when load on an engine increase or decrease, obviously its speed will, respectively decrease or increase to the extent of variation of load. This variation of speed has to be controlled by the governor, within small limits of mean speed. This necessitates that when the load increase and consequently the speed decreases, the supply of fuel to the engine has to be increased accordingly to compensate for the loss of the speed, so as to bring back the speed to the mean speed. Conversely, when the load decreases and speed increases, the supply of fuel has to be reduced. The function of the governor is to maintain the speed of an engine within specific limit whenever there is a variation of load. The governor should have its mechanism working in such a way, that the supply of fuel is automatically regulated according to the load requirement for maintaining approximately a constant speed. This is achieved by the principle of centrifugal force. The centrifugal type governors are based on the balancing of centrifugal force on the rotating balls by an equal and opposite radial force, known as the controlling force.

Governors are broadly classified as:

a) Centrifugal Governors.
b) Inertia Governors.

The centrifugal governors are based on the balancing of centrifugal force on the rotating balls by an equal and opposite radial force, known as controlling force.

In Inertia governors the position of the balls are affected by the forces set by an angular acceleration or deceleration of the given spindle in addition to centrifugal forces on the balls.

Proell Governor :- Proell governor is similar to the porter governor having a heavy central load at sleeve. But it differs from porter governor in the arrangement of balls. The balls are carried on the extension of the lower arms instead of at the junction of upper and lower arms.

The center sleeve of the Porter and Proell governors incorporates a weight sleeve to which weights can be added. The Hartnell governor consists of a frame, spring and bell crank lever. The spring tension can be increased or decreased to study the governor.

PROCEDURE:

Starting Procedure:

1. Assemble the governor to be tested.
2. Complete the electrical connections.
3. Switch ON the main power.
4. Note down the initial reading of pointer on the scale.
5. Switch On the rotary switch.
6. Slowly increase the speed of governor until the sleeve is lifted from its initial position by rotating Variac.
7. Let the governor be stabilized.
8. Increase the speed of governor in steps to get the different positions of sleeve lift at different RPM.
9. Increase the speed of governor in steps to get the different positions of sleeve lift at different RPM.

Closing Procedure:

1. Decrease the speed of governor gradually by bringing the Variac to zero position and then switch off the motor.
2. Switch OFF all switches.
3. Disconnect all the connections.
4. Draw the graph for governor as stated further in manual.
5. Repeat the experiment for different type of governor.

PRECAUTIONS :-

1. Take reading carefully.
2. Measure the angle very carefully.
3. Measure the height of governor carefully.
4. Speed of governor measure accurate.

OBSERVATION :-

- Mass of the ball (m) = ----------kg.
- Weight of the ball (w)=----------Newtons
- Height of the governor (h) = ------- metres
- Minimum equilibrium speed (N_1) = ------ r.p.m.
- Minimum equilibrium speed (N_2) = ------ r.p.m.
- Frictional force (F) = ---------- Newtons
- Mean equilibrium speed (N) = $(N_1 + N_2)/2$ in r.p.m
- Mass of the central load = ---------kg.
- Weight of the central load (W) = --------N
- Angle of inclination of the arm to the vertical (α) = ------
- Angle of inclination of the link to the vertical (β) = ------

OBSERVATION TABLE:

Initial reading of pointer on scale, X' = mm

Selected ball weight, w = kg

S. No.	Sleeve displacement, X" mm	Speed, N_{act} RPM

Plot the graph for following curves: -

1. Sleeve (X) vs. N_{tho}
2. Sleeve (X) vs $N_{act.}$

CALCULATION :-

- $N^2 = \frac{FM}{BM} \times [m + [M(1+q)]/2] \times \frac{895}{h}$ (For porter governor) where, $q = \tan\beta / \tan\alpha$

- Sensitiveness of the governor = $2(N_1 - N_2)/ N_1 + N_2 = 2(\omega_2 - \omega_1)/ \omega_2 + \omega_1$
- A governor is said to be stable when for every speed within the working range there is a definite configuration i.e; there is only one radius of rotation of the governor balls at which the governor is in equilibrium. For a stable governor, if the equilibrium speed increases, the radius of governor balls must also increase.

RESULT :-

- Sensitiveness of the governor is = ----------

SKITM Technical Campus, Indore

Department of Electronics & Communication Engineering

II –Year/III -Semester

EC-304 Electronic Devices

List of Experiments

1. To study and verify the characteristics of PN junction Diode.
2. To study and verify the characteristics of Zener Diode.
3. To study and verify the characteristics of LED.
4. To study and verify the characteristics of Photo Diode.
5. To study and verify the Clipper circuit.
6. To study and verify the Clamper circuit.
7. To study and verify the characteristics of half wave and Full wave rectifier.
8. To study and verify the characteristics of NPN transistor in CB configurations.
9. To study and verify the characteristics of NPN transistor in CE configurations.
10. To study and verify the characteristics of JFET.

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Faculty

Sneha Nagar

SKITM-Technical Campus, Indore

List of Experiments

Electronic Devices (EC304)

S. No.	Problem Statement	Mapping with CO					
		CO1	CO2	CO3	CO4	CO5	CO6
1	To Study and verify the V-I characteristics of P-N Junction Diode.	√				√	
2	To Study and verify reverse characteristics of Zener Diode.	√				√	
3	To Study and verify forward characteristics of Light Emitting Diode (LED).	√	√			√	
4	To Study and verify reverse characteristics of Photo-Diode.	√			√		
5	To Study and verify the clipper circuit.		√			√	
6	To Study and verify the clamper circuit.		√				
7	To Study and verify the Rectifier circuit.		√		√		√
8	To Study and verify the Characteristics of Bipolar Junction Transistor (BJT) Common Base Configuration.			√		√	
9	To Study and verify the Characteristics of Bipolar Junction Transistor (BJT) in Common Emitter Configuration.		√		√		
10	To Study and verify the Characteristics of Junction Field Effect Transistor (JFET).	√			√		√

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Department of Electronics and Communication Engineering

List of Experiments of Digital System Design (EC303)

DIGITAL SYSTEM DESIGN LAB

1. Study of different basic digital logic gates and verification of their Truth Table.
2. Study and verification of the law of Boolean Algebra and De-Morgan's Theorem.
3. Construction and verification of various combinational circuits such as Half Adder, Full Adder, Half & Full Subtractor.
4. Study of Multiplexer, De-multiplexer.
5. Study of Different Code Converters, Encoder, Decoder.
6. Construction and verification of various types of Flip-Flops using gates and IC's.
7. Construction and Verification of different Shift Registers.
8. Construction and verification of different types of Counters.

S. No.	Problem Statement
1	To study and verify the truth tables of various Logic gates To verify the properties of NAND and NOR gates as Universal Building Blocks.
2	Simplification and implementation of a Boolean function
3	Implementation of basic Boolean arithmetic logic circuits such as Half-adder, Half-subtractor, Full adder and Full subtractor
4	To design a Binary to BCD and BCD to excess-3 code converter.
5	Multiplexer ,Demultiplexer & Decoder Circuit
6	Basic memory element Flip-Flop
7	Study of Shift Registers
8	Study of Counters

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List of Experiments of Network Analysis (EC305)

EXPERIMENTS LIST:-

1. To Verify Thevenin Theorem and Superposition Theorem.
2. To Verify Reciprocity Theorem and Millman's Theorem.
3. To Verify Maximum Power Transfer Theorem.
4. To Determine Open Circuit and Short Circuit parameters of a Two Port Network.
5. To Determine A,B, C, D parameters of a Two Port Network.
6. To determine h parameters of a Two Port Network.
7. To Find Frequency Response of RLC Series Circuit RLC parallel Circuit and determine resonance and 3dB frequencies.
8. To determine charging and discharging times of Capacitors.

In network Lab

(1) To verify Kirchoff's Law.
(2) To observe Resonance phenomenon in series RLC circuit.
(3) To verify Thevenin's Theorem
(4) To verify Superposition Theorem
(5) To verify Norton's Theorem
(6) To verify Maximum Power Transfer Theorem
(7) To verify Reciprocity Theorem
(8) To verify Millman's Theorem
(9) To Find out various Parameter of two port network
(10) Use Tina-Pro as a computer tool to verify, design, and to confirm time-domain and frequency-domain analysis results.

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List of Experiments of Control systems (EC404)

Control System performance analysis and applications of MATLAB in Control system performance analysis & design.

In Analog circuits Lab

S. No.	Problem Statement
1	To study the MATLAB software.
2	To find the transfer function of a system using Matlab
3	To calculate the A closed loop control system when subjected to a unit step input.
4	To find a feed back control system has its forward path transfer function.
5	To Draw the Nyquist plot for the open loop transfer function.
6	To determine the stable transition matrix.

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List of Experiments of Analog Circuits (EC405)

To measure and compare the op-amp characteristics: offset voltages, bias currents, CMRR, Slew Rate of OPAMP LM741 and TL082.
2. To determine voltage gain and frequency response of inverting and non-inverting amplifiers using TL082.
3. To design an instrumentation amplifier and determine its voltage gain using TL082.
4. To design op-amp integrator (low pass filter) and determine its frequency response.
5. To design op-amp differentiator (high pass filter) and determine its frequency response.
6. Design 2nd order Butterworth filter using universal active filter topology with LM741
7. To design Astable, Monostable and Bistablemultivibrator using 555 and analyse its characteristics.
8. Automatic Gain Control (AGC) Automatic Volume Control (AVC)using multiplier MPY634
9. To design a PLL using opampwith MPY634 anddetermine the free running frequency, the capture range and the lock in range of PLL
10. Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with TPS7250 IC.

In Analog circuits Lab

Exp. No.	Title of the experiment
1	To determine and analyzethe V-I characteristics of PN Junction diode and Zener diode.
2	To determine input and output characteristics of transistor amplifiers in CE, CB &CC configurations.
3	To determine the frequency response of transistor CE amplifier, direct coupled and RC coupled amplifier.
4	To determinecharacteristics ofUJT as relaxation Oscillator.
5	To determineDrain and Transfer Characteristicsof JFET Amplifier.
6	To determineDrain and Transfer Characteristicsof MOSFET Amplifier
7	To determinecharacteristics of class A and Bpower amplifiers
8	To determine characteristics of classC and AB power amplifiers.

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SKITM-TECHNICAL CAMPUS, Indore		
DEPT. OF ELECTRONICS & COMMUNICATION ENGINEERING	**LIST OF EXPERIMENTS**	**SUBJECT:EC803A ADVANCE COMMUNICATION SYSTEM** FACULTY: VISHAL PAWAR

Sr.No.	AIM	OBJECTIVES
1.	Study of GSM System Architecture with its frame structure and GSM speech signal conditioning sequence	1.1To study a 2G system i.e. GSM System with Architecture in detail. 1.2 To study the Frame structure of GSM. 1.3 To study the GSM speech signal conditioning sequence.
2.	Study of the Forward & Reverse CDMA Channel for IS-95 Cellular System	2.1To study the 2G system i.e. IS-95 CDMA system in detail. 2.2Forward channel transmission sequence. 2.3 Forward channel transmission sequence
3.	Study of the MULTI-ANTENNA System	3.1SMART ANTENNAS 3.2 MIMO ANTENNAS
4.	Study of the COMMUNICATION TOOL BOX OF MATLAB including all the basic building blocks of a transceiver model of wireless communication system.	4.1To study a Communication System 4.2 To study the Signal Sources 4.3 To study the Channel Coding techniques 4.4 To study the Modulation Techniques 4.5 To study the various Channels
5.	Design a SIMULINK MODEL for CDMA2000 1xRTT Physical Layer so as to analyze the performance of CDMA2000 1xRTT in multipath Rayleigh fading/ AWGN channel environment	7.1Introduction to CDMA2000 1xRTT Physical Layer. 7.2Find out all the standard parameters for CDMA2000 1xRTT Physical Layer. 7.3 Encoder. The encoder subsystem performs these tasks: Insertion of frame quality indicator, Appending of tail bits before coding,

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SKITM-TECHNICAL CAMPUS, Indore		
DEPT. OF ELECTRONICS & COMMUNICATION ENGINEERING	**LIST OF EXPERIMENTS**	**SUBJECT:EC803A ADVANCE COMMUNICATION SYSTEM** **FACULTY: VISHAL PAWAR**

		Convolutional encoding, Repetition, Puncturing and Block interleaving.

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SKITM-Technical Campus, Indore
List of Experiments
Digital Signal Processing (EC601)

S. No.	Problem Statement	Mapping with CO					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Representation of various signals like sine, cosine, square and ramp using MATLAB.	√					
2	To Compute of Z Transform using MATLAB.	√					
3	To Compute of Linear and Circular convolution using MATLAB.	√	√				
4	To Compute of Discrete Fourier Transform using Scilab.using MATLAB.	√					
5	To Compute of Inverse Discrete Fourier Transform using MATLAB.		√				
6	To Study of DSP Kit (TMS320C6713 DSK)		√				
7	To Compute Linear and circular Convolution using code composer studio on TMS320C6713 DSK.		√			√	
8	To Generate of sine waveform, Square waveform using code composer studio on TMS320C6713 DSK.			√			
9	Solution of difference equation using code composer studio on TMS320C6713 DSK.				√		
10	Frequency Shift Keying & Amplitude Shift Keying using code composer studio on TMS320C6713 DSK.				√		

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Laboratory of Antenna and Wave Propagation (EC602)

S. No.	AIM	LEARNING OBJECTIVES	STUDENT OUTCOMES
01	Functional characteristic and specifications of the antenna trainer kit with different antennas.	• To use the antenna trainer kit for plotting radiation patterns of different antennas. • To understand the use the different antennas for different applications. • To be able to formulate various problems encountered in mounting the antennas	• An ability to understand the technical specifications of antenna trainer kit and use it in plotting the radiation characteristics of different antennas. • An ability to recognize the design characteristics of different antennas.
02	Variation of field strength of radiated wave, with distance from transmitting antenna.	• To mount the antenna & plot the inverse square law characteristic for the receiver antenna. • To understand the inverse square law principle for antenna transmission and reception. • To plot the graph between power and distance for the receiver antenna. • To observe the effect of alignment & mismatch on the radiation pattern.	• An ability to appreciate the square law characteristic plot of the receiver antenna. • An ability to correlate the distance and power for antenna reception. • An ability to understand the different types of field pattern for antennas based on the distance from the transmitting antenna
03	Radiation pattern of an Omni Directional Antenna (monopole, simple dipole $\lambda/2$, simple dipole $\lambda/4$ and folded dipole $\lambda/2$, Zeppelin) & its beam width, front to back ratio & gain.	• To be able to mount the monopole antennas & plot the radiation pattern. • To be able to use various antennas & find out their gain, FBR & beam width by plotting their radiation pattern. • To be able to formulate various problems encountered in taking the radiation pattern. • To be able to simulate and plot the Radiation pattern of an Omni Directional Antenna using MATLAB/SCILAB.	• An ability to appreciate various properties of monopole antennas with Omni directional radiation pattern. • An ability to correlate the concept of beam width, gain & FBR antenna for various purposes. • An ability to measure the field strength in terms of μA current & to trace the amount of current flowing in forward & backward directions.
04	Radiation pattern of a Yagi - Uda 3, 4, 5 & 7 element simple dipole antennas/Ground plane with Reflector and Director antennas and calculate different terminologies.	• To be able to differentiate between different Yagi - Uda 3, 4, 5 & 7 element simple dipole antennas/Ground plane with Reflector and Director antennas and their terminologies • To be able to plot the radiation pattern in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), FBR, SLL and its angular position, plane of polarization, directivity & gain. • To be able to comprehend antenna resonance and measure VSWR, impedance using DIRECTIONAL COUPLER and adjust the antenna dimensions for resonance. • To be able to appreciate the significance of parasitic elements by varying element lengths. • To be able to simulate and plot the Radiation pattern MATLAB/SCILAB.	• An ability to appreciate various properties of Yagi-Uda antennas using radiation pattern. • An ability to understand the importance of parasitic array in changing the radiation pattern in the desired direction. • An ability to understand the effect of no. of elements and their role as directors and reflectors in the antenna performance.
05	Radiation pattern of a Yagi - Uda 3 & 5 element folded dipole antenna & calculate its beam width, front to back ratio & gain.	• To be able to differentiate between different Yagi - Uda simple dipole antennas and folded dipole antenna with Reflector and Director antennas and their terminologies • To be able to plot the radiation pattern in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), FBR, SLL and its angular position, plane of polarization, directivity & gain. • To be able to comprehend antenna resonance and measure VSWR, impedance using DIRECTIONAL COUPLER and adjust the antenna dimensions for resonance. • To be able to appreciate the significance of parasitic elements and active elements on varying element lengths. • To be able to simulate and plot the Radiation pattern using MATLAB/SCILAB.	• An ability to appreciate various properties of Yagi-Uda folded dipole antennas using radiation pattern. • An ability to understand the importance of parasitic and active elements in changing the radiation pattern in the desired direction. • An ability to understand the effect of no. of elements and their role as directors and reflectors in the antenna performance.
06	Linear polarization test for simple dipole $\lambda/2$ antenna.	• To be able to mount the antennas & perform their alignment to observe the effect of polarization. • To understand the meaning of polarization & its importance in antenna theory. • To be able to simulate and plot the Radiation pattern using MATLAB/SCILAB.	• An ability to appreciate the importance of polarization & use them in finding the antenna terminologies. • To measure the field strength in terms of μA current & to trace the amount of current flowing in forward & backward directions.

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			• To place the antenna suitably in order to maximize the transmission and reception.
07	Measurement of Resonant frequency, VSWR and impedance of resonant antenna.	• To be able to perform the techniques required for matching of stub line. • To be able to measure the standing wave ratio & the amount of reflections due to impedance mismatch.	• An ability to appreciate the importance of matching the stub line. • An ability to measure the standing wave ratio in terms of currents flowing in forward & backward directions.
08	Reciprocity theorem of antennas.	• To be able to verify the Reciprocity Theorem. • To be able to learn the various applications of the Reciprocity Theorem.	• An ability to appreciate the importance of the Reciprocity Theorem. • An ability to apply Reciprocity Theorem for calculating antenna terminologies.
09	Radiation pattern of end-fire array (λ/2 phase array), λ/4 phase array antenna.	• To be able to use end fire (EF) array and plot its radiation pattern. • To be able to differentiate antenna array and compare it to normal antenna. • To be able to formulate various parameters of end fire array. • To be able to plot the radiation pattern of EF in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its angular position, plane of polarization, directivity & gain of the EF antenna • To be able to study antenna resonance and measure VSWR, impedance using DIRECTIONAL COUPLER and adjust the antenna dimensions for resonance..	• An ability to understand the concept of array. • An ability to understand the types of array and find out their applications
10	Radiation pattern of broad-side (λ/2 phase array) antenna.	• To be able to use broad side (BS) array and plot its radiation pattern. • To be able to differentiate BS and EF antenna array and compare them to normal antenna. • To be able to formulate various parameters of BS array. • To be able to plot the radiation pattern of BS antenna in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its angular position, plane of polarization, directivity & gain of the broad side antenna • To be able to study antenna resonance and measure VSWR, impedance using DIRECTIONAL COUPLER and adjust the antenna dimensions for resonance.	• An ability to understand the concept of broadside array and differentiate between end fire and broadside array. • An ability to understand the applications and properties of broadside array.
11	Radiation pattern of the square and quad Loop Antenna.	• To be able to analyze loop antenna and plot its radiation pattern. • To be able to compare and differentiate loop antenna and dipole antenna. • To be able to formulate various parameters of loop antenna. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its angular position, plane of polarization, directivity & gain of the loop antenna • To be able to study antenna resonance and measure VSWR, impedance using DIRECTIONAL COUPLER and adjust the antenna dimensions for resonance.	• An ability to understand the concept of loop antenna. • An ability to understand the applications and properties of loop antenna
12	Radiation pattern of the crossed dipole circularly polarized Antenna.	• To be able to plot the radiation pattern of Crossed dipole antenna in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its angular position, plane of polarization, directivity & gain of the loop antenna. • To be able to study antenna resonance and measure VSWR, impedance using DIRECTIONAL COUPLER and adjust the antenna dimensions for resonance. • To be able to find the gain bandwidth of the Crossed dipole antenna using a log-periodic antenna. • To be able to find polarization discrimination between LHCP & RHCP crossed dipole antennas. Find whether a dipole antenna can distinguish between LHCP & RHCP antennas.	• An ability to understand the polarization concept of loop antenna. • An ability to understand the applications and properties of different polarized antennas.
13	Radiation pattern of the monofiliar axial mode Helix antenna	• To be able to plot the radiation pattern of monofiliar axial mode helix antenna in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its angular position, plane of polarization and directive gain of the monofiliar helix antenna • To be able to study antenna resonance and estimate VSWR and bandwidth using RLB.	• An ability to understand the concept of Helix antennas & their applications. • An ability to understand the polarization of the Helix antenna.

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		• To be able to find the gain bandwidth of the monofiliar axial mode helix antenna antenna using a log-periodic antenna. • To be able to find polarization discrimination between LHCP & RHCP monofiliar axial mode helix antennas, when communicated against each other. Find whether a dipole antenna can distinguish between LHCP & RHCP antennas. • To be able to find out if pairing the same handedness antennas (like RHCP helix and RHCP Crossed dipole or LHCP Helix and LHCP crossed dipole) against each other will result in more signal strength.	
14	Radiation pattern of the Log periodic antenna.	• To be able to plot the radiation pattern of Log-periodic antenna in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its angular position, plane of polarization and directive gain of the Log-periodic antenna	• To understand the concept of Log-periodic antennas & their applications. • To understand the polarization of the log periodic antenna. • To understand the frequency independency of log periodic antenna.
15	Radiation pattern of the Rhombus antenna.	• To be able to plot the radiation pattern of Rhombus antenna in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its position, plane of polarization and directive gain of the Rhombus antenna.	• An ability to understand the concept of Rhombus antenna & their applications. • An ability to understand the applications of Rhombus antenna.
16	Radiation pattern of the Slot Antenna	• To be able to plot the radiation pattern of Slot antenna in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its position, plane of polarization and directive gain of the Slot antenna.	• An ability to understand the operation of slot antenna. • An ability to understand the concept of duality of slot antenna.
17	Radiation pattern of the Sleeve antenna.	• To be able to plot the radiation pattern of Sleeve antenna in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its angular position, plane of polarization and directive gain of the Sleeve antenna.	• To understand the operation of sleeve antenna. • To understand the applications of sleeve antenna.
18	Radiation pattern of the Micro-strip antenna.	• To be able to plot the radiation pattern of Micro-strip antenna in Azimuth & Elevation planes on log & linear scales on polar and Cartesian plots. • To be able to measure the beam width (-3dB), front to back ratio, side lobe level and its position, plane of polarization and directive gain of the Micro-strip antenna.	• An ability to understand the various properties of the Micro-strip antennas & use them in finding the antenna terminologies. • An ability to understand the types of Micro-strip antenna for various purpose.

Prepared by: Dr. Amit Udawat

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Department of Electronics and Communication

Optical Communication LAB (EC 7003)

List of Experiments

S.No.	AIM	OBJECTIVE	PROBLEM STATEMENT
1	To study and perform the Setting of Optical Fiber Analog link	1.To establish a Fiber link between a LED & PIN photodiode at wavelength 950 nm. 2.To compare relationship between input signal & received signal. 3.To measure analog bandwidth of link in KHz. 4.To Plot a Gain vs. Frequency curve (Amplitude Response) of the link.	1. To understand the LED and PIN photodiode. 2.To understand the operating frequency range. 3. To understand Snell's law. 4.To understand Dispersion.
2	To Study and perform the Setting of Optical Fiber Digital link.	1.To establish an Optical Fiber digital link between a transmitter & Receiver. 2.To compare relationship between transmitted signal & received signal	1. To appreciate the various properties of the antenna & use them in finding the antenna terminologies. 2. To correlate the concept of beam-width, gain & FBR antenna for various purpose. 3. To measure the field strength in terms of µA current & to trace the amount of current flowing in forward & backward directions.
3	To measure losses in Optical Fiber	1.To measure Propagation loss at different wavelength. 2.To measure the bending losses. 3.To compare losses at various wavelength.	1To understand Optical Fiber windows & its ranges. 2.To observe types of losses in optical fiber. 3.ObserveScattering in optical fiber. 4.To understand the variation of output light in acording to change the path of fiber cable
4	To measure the Numerical Aperture (NA) of the Optical fiber	1.The Study effect of Numerical Aperture on transmission through optical fiber. 2.Measure the acceptance angle. 3.Measure Maximum incidence angle	1.To understand the range of NA of step index fiber. 2.To understand following: a. Ctritical Anlge.. b. Acceptance angle 3.To Understand Mode Field Diameter. 4.To understand Normalized Difference.
5	To study and plot characteristics of Fiber Optic LED and Photo detector	1.To establish a Fiber link between a LED & PIN photodiode. 2.To compare relationship between input signal energy & received signal energy. 3.To characterize input Voltage-Current and Output Voltage and Current.	1.To understand difference between LED and normal PN Diode. 2.To understand working of Photo Detector. 3.Plot V-I characteristics for PN doide and LED and then compare them.
6	To Study and plot Eye Pattern.	1.To plot Eye Pattern. 2.To Study the importance of eye pattern in Digital Communication.	1.Setting up the DSO and Function Generator with kit (fiber optic kit). 2.To understand the role of Eye pattern in Digital communication.
7	To Study and preform Time Division Multiplexing	1.To perform simultaneous transmission of several signals using time division multiplexing. 2.To perform Generation of TDM frames for Digital Communication. 3.To perform the Time Division De multiplexing.	1.To understand the multiplexing and its varioud type. 2.To understand synchronous & asynchronous digital multiplexing

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LAB MANUAL

SURVEYING

(CE-303)

Session: 2022-23

Director
Shivajirao Kadam Institute of Technology & Management - Technical Campus, INDORE

DEPARTMENT OF CIVIL ENGINEERING - KITM INDORE

Prepared By

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(LabManual)

Department of Civil Engineering

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DEPARTMENT OF CIVIL ENGINEERING
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INDORE

Shivajirao Kadam Institute of Technology & Management, Indore
Department: - Civil Engineering
Subject Name: - Surveying (CE-303)

Experiment No.	Name of Experiments
1	Chain Surveying
2	Plane Table Surveying
3	Theodolite Traverse Surveying
4	Theodolite Traverse Surveying
5	Leveling / Route Surveying
6	House Setting
7	Setting out a Simple Circular Curve on Field
8	Height Measurement
9	Stadia Survey/ Tacheometry
10	Contouring
11	Global Positioning System

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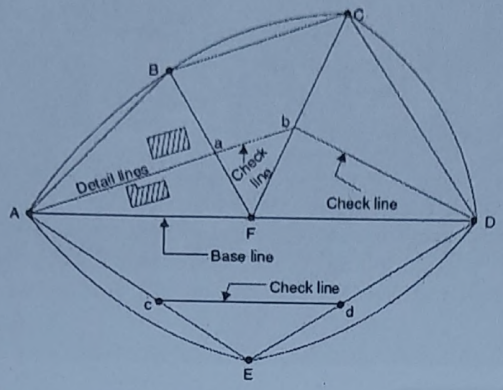
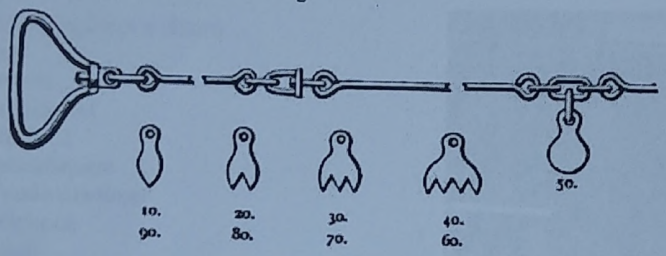
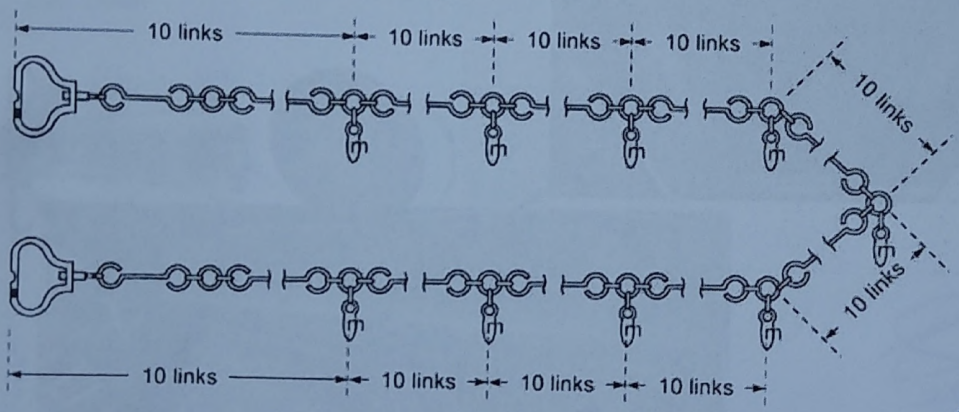
Experiment No.1
CHAINSURVEYING







Objective: To plot a small area by chain surveying

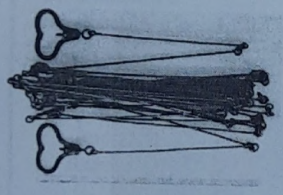
Theory:
It is a method of surveying in which the area to be divided into a number of triangles. Thelengths of the sides are measured and the interior details are recorded. The whole area is thenplottedon adrawingsheet to asuitablescale to prepare amap.

Todivideasmallareaintoanumberoftriangles,measuretheperpendiculardistance(offsets) of various objects in the field from the line and record in the field book from whichtheareacan beplotted on adrawingsheet to asuitablescale.

Significance:
Chain survey is the simplest and commonest method used in surveying exercises. Because of it sease of use ,it isused during reconnaissance survey a saquickme thodofsurveyingtogeta rough idea in the location to be surveyed. After participating in this fieldwork students willbecome more comfortable with handling chain and ranging rods. They will be more aware toobstacles in chaining and ranging and will learn to overcome the difficulties in chaining andranging.

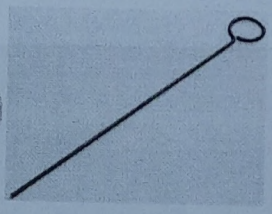
Instruments:

1. Chain(Engineer's chain)
2. Tape
3. Arrows
4. Rangingrod
5. Offsetrod
6. Opticalsquare
7. WoodenHammer
8. Fieldbook
9. Pencil

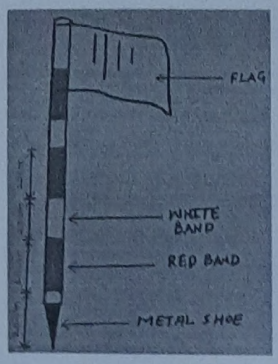


Chain

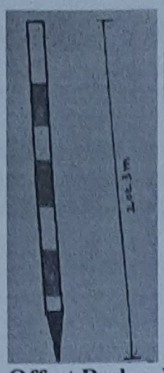
Tape



Arrow



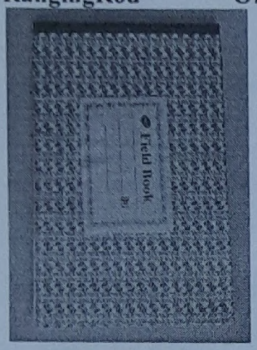
RangingRod



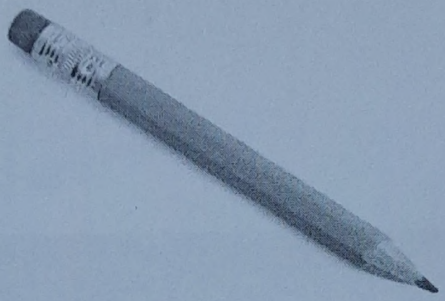
Offset Rod

WoodenHammer

OpticalSquare



FieldBook



Pencil

Figure1.1:Instruments Usedin ChainSurveying

Procedure:

Theentire procedure for chain surveying can be divided into three major groups.

a. *Fieldwork*
b. *Keepingofrecordsin thefieldbook*
c. *Plottingof datato preparemaps.*

a. Field work: It includes reconnaissance, selection of station, measurement of lines andtakingoffsets of differentobjects in the field

i. **Reconnaissance:** Before starting the actual survey measurement, the surveyor willwork around the area to fix the base position of survey lines and survey position.Duringreconnaissance,thesurveyorwillpreparearoughsketchofthearea showingthe possiblestationsand from therethearrangement o differentlines.

ii. **Selection of station:** The station should be marked by driving wooden pegs. Ifpossible,everystationshould belocatedwithrespect tothreepermanent objects.

iii. **Measurement of lines and taking offsets:** After selecting survey station, thechaining will be started from base line. Two ranging rods are fixed on the twostation in a survey line and distance is measured with chain. The chain should beproperly stretched so that no sag in it. As the measurement proceeds, offsets aretakenonthebothsidesofthesurveylinesandrecordedinthefieldbook.Offsets